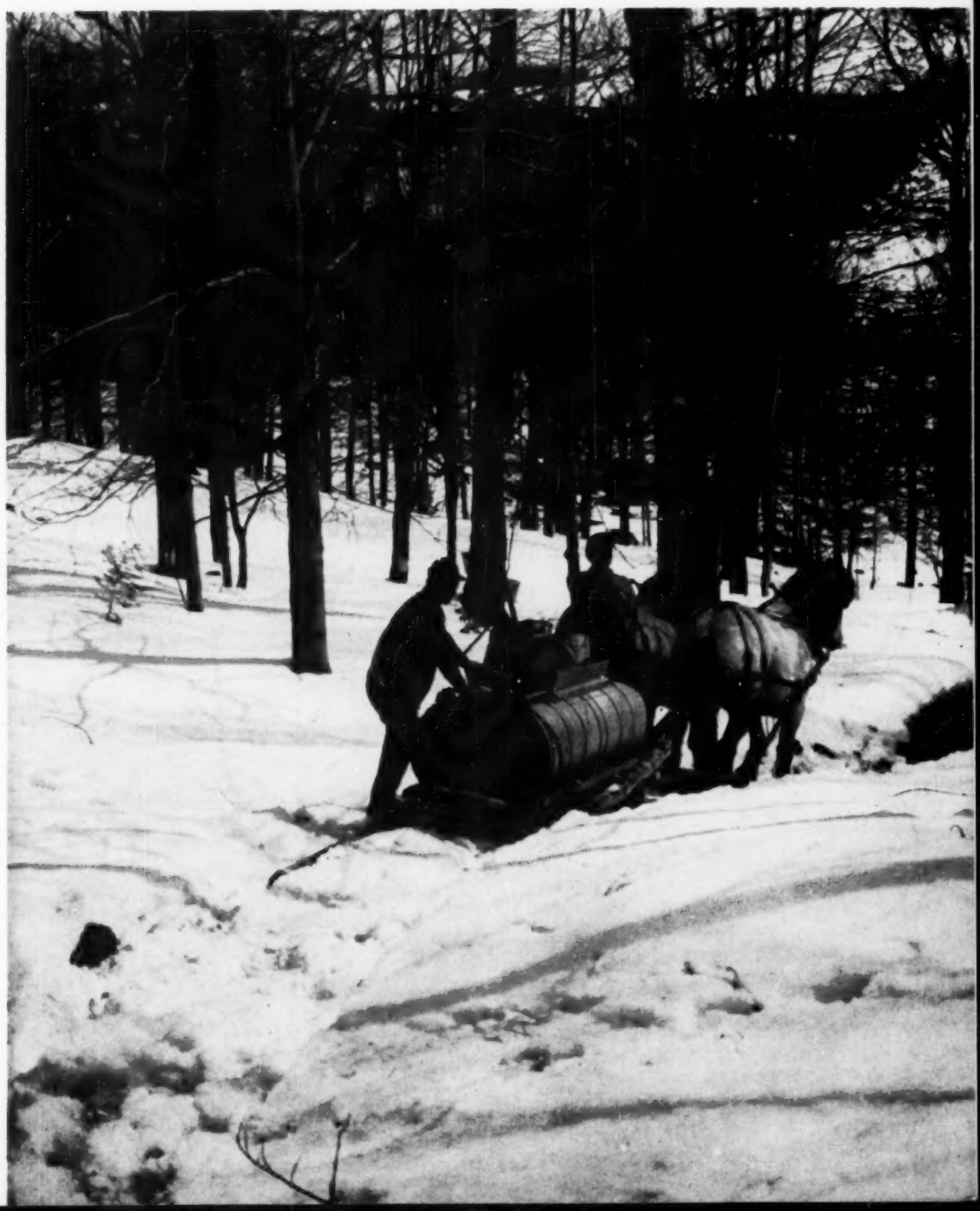
# Journal of FORESTRY

FEBRUARY 1953



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Volume 51
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*Photo by U. S. Forest Service*

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Journal of Forestry

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# Income From Timber Products in the United States

Lee M. James
and James G. Yoho
Department of Forestry, Michigan State College, East Lansing.

ESTIMATES OF VALUE and income arising from the harvesting and processing of timber products are presented in this article. These estimates do not include the important water, forage, recreation, and other non-timber products whose evaluation is more elusive and requires different approaches. The figures all relate to the year 1950.

## Explanation of Items Included in Estimates

Raw timber products refers to whole or slightly modified logs and bolts;[1] also bark, stumps, and crude gum. Their value is calculated at the point of processing or consumption, but before manufacture. Data are based on records and estimates of the Division of Forest Economics, U. S. Forest Service.

Values added by manufacture of major timber industry groups were obtained from the *1950 Annual Survey of Manufacturers* of the U. S. Bureau of the Census. Group totals were broken down according to the value relationships among component timber industries shown by the detailed 1947 census of manufactures. Value added by manufacture is defined as "value of products less cost of materials, supplies, fuel, electric energy, and contract work." Industry groups included are those listed by the census as follows: lumber and products (except furniture), paper and allied products, wood house furniture (except upholstered), wood office furniture, and gum and wood chemicals.

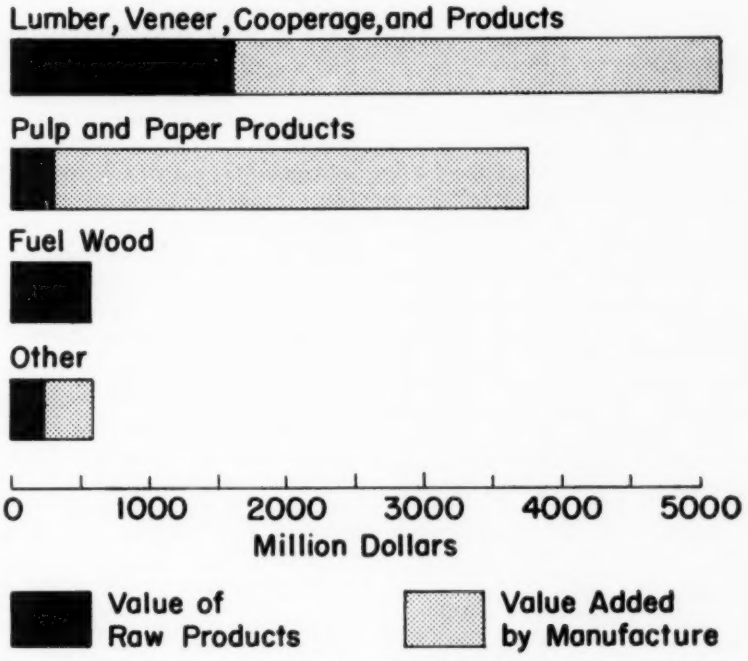


FIG. 1.—Value of raw timber products in the United States and value added by manufacture, 1950.

Estimates of the value added by manufacture of lumber and furniture are probably low. In lumber, there is a question as to whether the census has sampled fully the production of the innumerable, migratory, small sawmills. In furniture, a large but unspecified amount of wood is used by furniture industries not designated by the census as wood furniture.

The concept of income used in this article includes money payments to individuals from all sources except government. It includes wages and salaries, net profits, interest, and net rents.

Income from timber products was calculated by the authors in two phases: (1) income from raw timber; and (2) income from timber manufactures. Income from raw timber is taken to be the total value of raw timber minus the value of raw timber unsold (mainly fuel wood and fence posts). Income from timber manufactures is considered to be that part of value added which covers wages and salaries and net profits. Data on wages and salaries were obtained from the *1950 Annual Survey of Manufacturers* and other Census Bureau publications. Net profits

[1] Sawlogs, veneer logs, cooperage bolts, pulpwood, fuel wood, poles, piling, mine timbers, hewn ties, posts, excelsior bolts, shingle and shake bolts, and miscellaneous logs and bolts.

TABLE 1.—VALUE OF RAW TIMBER PRODUCTS BY REGION, 1950

| Region | Sawlogs, veneer, and cooperage logs and bolts | Pulpwood | Fuel wood and fence posts | Miscellaneous | All timber |
|---|---|---|---|---|---|
| | | | *Million dollars* | | |
| Northeast | 83 | 47 | 30 | 24 | 184 |
| Central | 79 | 2 | 59 | 20 | 160 |
| Lake | 53 | 34 | 66 | 5 | 158 |
| South | 547 | 151 | 342 | 149 | 1,189 |
| West Coast | 723 | 61 | 45 | 29 | 858 |
| Rocky Mountain and Plains | 87 | 2 | 12 | 7 | 108 |
| Total U. S. | 1,572 | 297 | 554 | 234 | 2,657 |

estimates were based on numerous annual reports of timber products firms.

Other income payments used in this article—total income and income from farming, trades and services, manufacturing, and miscellaneous sources—were obtained from published data of the U. S. Department of Commerce.[2] These data have been adjusted so as to exclude timber products.

No attempt is made to appraise the full economic impact of timber products on the national economy. For example, a large part of the total lumber output goes into construction. It might, therefore, be valid for some purposes to point out that a portion of the income payments obtained in the construction industry is dependent on lumber. If inquiry were aimed at all income traceable to lumber, it could also be shown that many trades and services are dependent on the production and manufacture of timber products. But in this article the estimates of income payments to individuals derived from timber products are totaled only to the points of consumption considered in the Census Bureau estimates of manufactures.

[2]Graham, R. E., Jr. State income payments in 1950, Surv. Current Bus. 31: 11-21. U. S. Bur. For. and Dom. Commerce. Aug. 1951.

### Nationwide Value and Income

The annual output of raw timber products in the United States is worth $2.7 billion. Further manufacture adds $7.3 billion in value. The lumber-log group of products—lumber, veneer, cooperage, and their derived products including furniture—accounts for 59 percent of the total value of raw products and 48 percent of the value added by manufacture (Fig. 1). The pulp and paper group lags far behind in raw timber value (equal to less than a fifth of the lumber-log group), but its value added by manufacture is almost as large as that of the lumber-log group.

Income payments to individuals which are directly attributable to the production and manufacture of timber products are calculated at $8 billion. This is 4.4 percent of the nation's total income of $182 billion from all sources other than government payments. It compares with $16 billion from farming, $57 billion from trades and services, $45 billion from nontimber manufacturing, and $56 billion from miscellaneous sources.

### Value of Timber Products by Region[3]

The South and the West Coast are the dominant regions in the production of raw timber (Table 1). In terms of value, the South produces 45 percent of the nation's raw timber; the West Coast, 32 percent. All other regions lag far behind.

The western regions are more specialized in that the great bulk of their raw timber output is in one group—sawlogs, veneer logs and bolts, and cooperage logs and bolts. A consequence is that the West Coast is ahead of the South in its value output of these products. In each of the other three groups of products recognized, however, the South produces more than one-

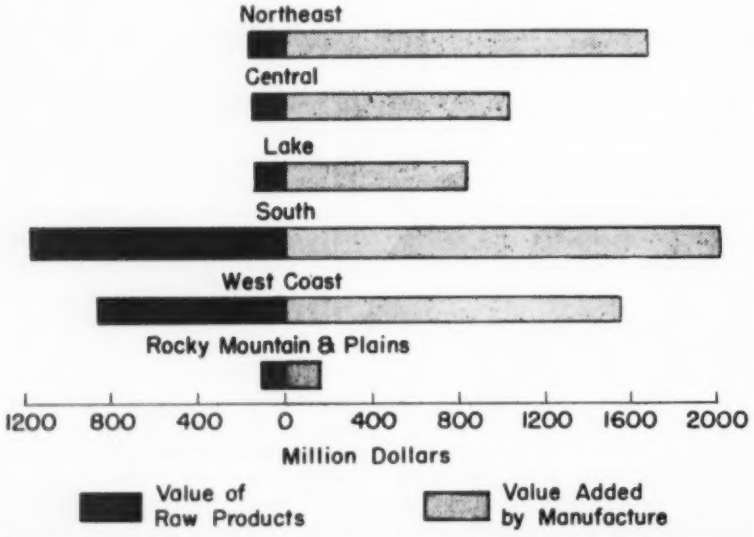


FIG. 2.—Value of raw timber products and value added by manufacture, by region, 1950.

[3]Six regions are recognized in this article as follows:

Northeast — Connecticut, Delaware, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont;

Central—Illinois, Indiana, Iowa, Kentucky, Missouri, Ohio, West Virginia;

Lake—Michigan, Minnesota, Wisconsin;

South—Alabama, Arkansas, District of Columbia, Florida, Georgia, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia;

West Coast—California, Oregon, Washington;

Rocky Mountain and Plains—Arizona, Colorado, Idaho, Kansas, Montana, Nebraska, Nevada, New Mexico, North Dakota, South Dakota, Utah, Wyoming.

half of the nation's total value output.

Regional contrasts show up differently in value added by manufacture of timber products (Table 2 and Fig. 2). The South and the West Coast have similar positions in relation to each other as was shown above in respect to raw timber values; but the northern regions — Northeast, Central, and Lake—are much more vigorous manufacturing regions. Note the ratios of value added by manufacture to value of raw timber in the lumber, veneer, cooperage, and products group: Northeast, 4.6 to 1; Central 5.4; Lake, 4.9; South, 2.1; West Coast, 1.6; and Rocky Mountain and Plains, 1.6. In the pulp and paper products group the great manufacturing role of the northern regions is far more striking. Here the ratios of value added by manufacture to value of raw timber are as follows: Northeast, 27 to 1; Central, 243; Lake, 16; South, 5; West Coast, 5; and Rocky Mountain and Plains 10.

Highly developed manufacturing and importing raw and partly processed timber for the purpose of manufacture makes the Northeast second only to the South in value added by manufacture of timber products. Taking the northern (Northeast, Central, and Lake) regions together, value added is roughly equal to that of the South and West Coast regions combined.

### Income Payments from Timber Products by Region

In terms of income payments to individuals which can be attributed directly to timber products (both the production of raw timber and the manufacture of timber products), the South ranks first, the West Coast second (Fig. 3). The leading northern region — the Northeast—accounts for less than a fifth of the total income from timber products; but the Northeast, Lake, and Central regions combined account for substantially more timber income than does the South.

Perhaps of more significance, regionally speaking, is the contrast of timber income with income payments from other sources (Table 3). Here, it is seen that in relation to the total regional economy, timber income looms largest on the West Coast. The South also leans heavily on timber, but to a somewhat lesser degree. Even with the omission of Texas and Oklahoma, the remaining South would have 9 percent of its income other than government payments coming from timber products, as compared with the West Coast's 10 percent. Timber plays a lesser role in the economies of the other four regions. These are, of course, broad generalizations. Locally, timber products may be very important in all regions.

TABLE 2.—VALUE ADDED BY MANUFACTURE OF TIMBER PRODUCTS, BY REGION, 1950

| Region | Lumber, veneer, cooperage, and products | Pulp and paper products | Miscellaneous | All timber |
|---|---|---|---|---|
| | | *Million dollars* | | |
| Northeast | 380 | 1,246 | 65 | 1,691 |
| Central | 424 | 559 | 45 | 1,028 |
| Lake | 261 | 534 | 42 | 837 |
| South | 1,139 | 749 | 138 | 2,026 |
| West Coast | 1,179 | 318 | 33 | 1,530 |
| Rocky Mountain and Plains | 144 | 14 | 12 | 170 |
| Total U. S. | 3,527 | 3,420 | 335 | 7,282 |

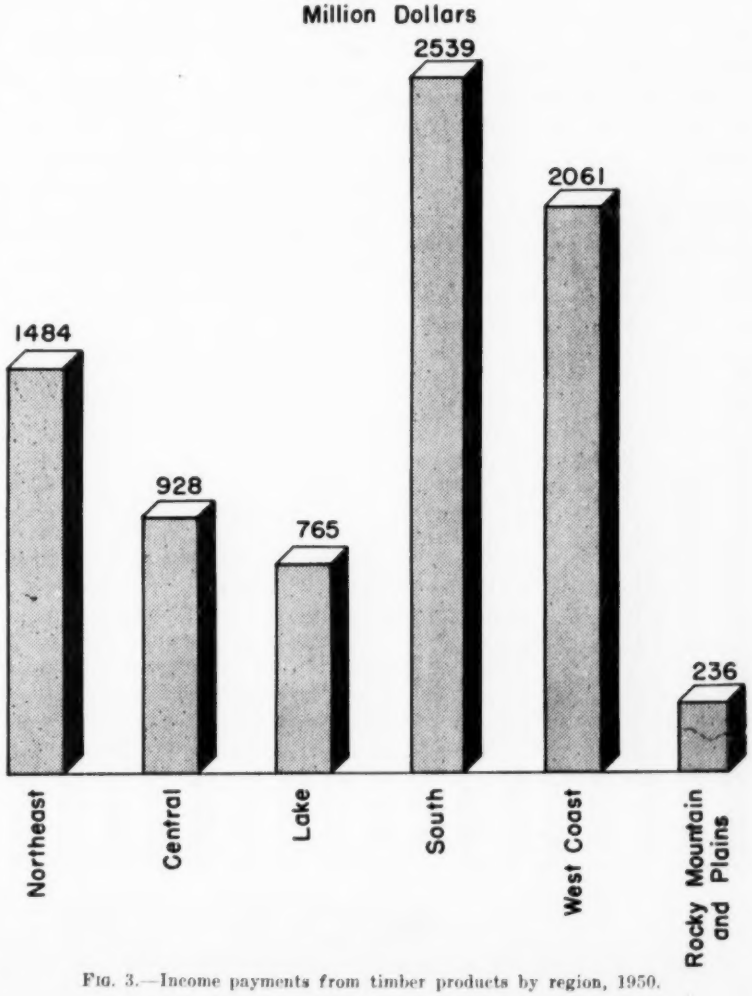


FIG. 3.—Income payments from timber products by region, 1950.

TABLE 3.—TOTAL REGIONAL INCOME PAYMENTS TO INDIVIDUALS OTHER THAN GOVERNMENT PAYMENTS, BY MAJOR SOURCE, 1950

| Region | All income | Timber products | Farming | Trades and services | Manufacturing other than timber products | Miscellaneous |
|---|---|---|---|---|---|---|
| | *Million dollars* | *Percent* | | | | |
| Northeast | 57,475 | 2.6 | 1.9 | 32.3 | 29.9 | 33.3 |
| Central | 41,404 | 2.2 | 9.5 | 25.0 | 29.6 | 29.7 |
| Lake | 16,586 | 4.6 | 8.4 | 27.4 | 35.1 | 24.5 |
| South | 35,772 | 7.1 | 14.2 | 32.7 | 16.2 | 29.8 |
| West Coast | 20,062 | 10.3 | 8.7 | 35.5 | 15.3 | 30.2 |
| Rocky Mountain and Plains | 10,810 | 2.2 | 26.7 | 29.6 | 8.5 | 33.0 |
| Total U. S. | 182,109 | 4.4 | 8.9 | 31.4 | 24.7 | 30.6 |

Contrasts in income payments to individuals from timber products and farming (Table 3) are of some interest but they should not be taken as a strict measure of the relative contributions of farming and timber to the regional economies.[4] Both on the West Coast and in the Northeast, income from the production and manufacture of timber products is substantially greater than income from farming. In the other four regions farming is clearly a greater source of income.

[4]Income from farming is not carried through manufacturing stages. It is calculated by the U. S. Department of Commerce as the sum of the net income of farm operators, farm wages, and farm rents received by farmer landlords.

## Income Payments from Timber Products by State

Income payments to individuals from timber products total at least $100 million in each of 26 states (Fig. 4). The combined timber income in these states is $7,371 million, or 92 percent of all timber income in the nation.

Oregon's population obtains considerably more income from timber products than the populations of Washington and California, the second and third place states. The high rank of New York and Michigan—in fourth and fifth places—may surprise some observers, but the reason for their high rank is apparent from an examination of the vertical bars representing timber income in Figure 4. The bottom of each bar (solid black) represents income from raw timber. The upper part of the bar (gray) represents income from timber manufacture. Note the high ratio of manufacturing to raw product in New York (16 to 1) and in Michigan (6 to 1). Comparable ratios for the West Coast states are much lower: in Oregon, the ratio is 1 to 1; and in both Washington and California, it is 2 to 1.

Because of their highly developed manufacturing, a number of other states which produce very little raw timber are among the 26 states in which income payments from timber products total at least $100 million. In Ohio less than $15 million of income is derived from raw timber; in Illinois $8 million; Massachusetts, $4 million; Indiana, $11 million; and New Jersey, $4 million.

In some of the states in which timber income payments total at least $100 million, timber products represent a large part of the overall economy (Table 4). Oregon's population, with 44 percent of its total income other than government payments arising from timber products, is most clearly dependent on timber. In Washing-

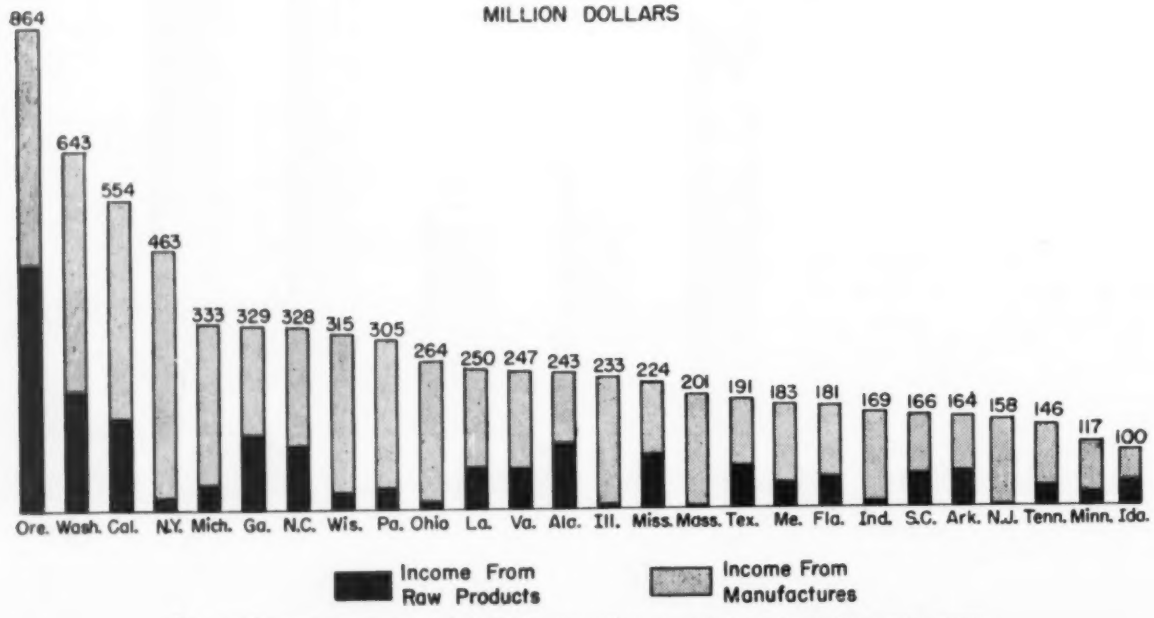


FIG. 4.—Income payments to individuals from timber products in 26 leading states, 1950.

ton, Maine, and Mississippi, timber products are the direct source of about a fifth of the income. The populations of seven other states (six of them southern) have more than 10 percent of their income payments derived from timber products. In two states not listed, New Hampshire and Vermont, timber income also exceeds the 10 percent mark.

Table 4 emphasizes the importance of timber products in individual states by contrasting timber income with income from other major sources. In Washington income payments from the production and manufacture of timber products is equal to farming and nontimber manufacturing income combined; and in Oregon timber income is more than twice as much. In Maine timber income is three times farming income. Timber income exceeds farming income in New York, Michigan, Louisiana, Massachusetts, and New Jersey, and it exceeds nontimber manufacturing income in Mississippi, Florida, Arkansas, and Idaho. In most other states income from the production and manufacture of timber products is not as large as farming or nontimber manufacturing income, but the significant role of timber products in the basic economy is clear.

TABLE 4.—TOTAL INCOME PAYMENTS TO INDIVIDUALS OTHER THAN GOVERNMENT PAYMENTS IN SELECTED STATES[1] BY MAJOR SOURCE, 1950

| State | All income | Timber products | Farming | Trades and services | Manufacturing other than timber products | Miscellaneous |
|---|---|---|---|---|---|---|
| | *Million dollars* | *Percent* | | | | |
| Oregon | 1,967 | 43.9 | 10.4 | 32.3 | 9.2 | 4.2 |
| Washington | 3,020 | 21.3 | 9.8 | 34.0 | 11.6 | 23.3 |
| California | 15,075 | 3.7 | 8.2 | 36.2 | 16.9 | 35.0 |
| New York | 24,367 | 1.9 | 1.5 | 36.8 | 24.6 | 35.2 |
| Michigan | 8,882 | 3.7 | 3.6 | 25.9 | 44.7 | 22.1 |
| Georgia | 2,691 | 12.2 | 13.4 | 33.0 | 19.4 | 22.0 |
| North Carolina | 3,205 | 10.2 | 18.7 | 26.9 | 25.8 | 18.4 |
| Wisconsin | 4,338 | 7.3 | 11.3 | 28.0 | 29.5 | 23.9 |
| Pennsylvania | 13,585 | 2.2 | 2.3 | 29.0 | 32.6 | 33.9 |
| Ohio | 10,979 | 2.4 | 4.2 | 28.0 | 37.5 | 27.9 |
| Louisiana | 2,216 | 11.3 | 10.9 | 33.2 | 11.9 | 32.7 |
| Virginia | 2,667 | 9.3 | 11.6 | 32.0 | 17.7 | 29.4 |
| Alabama | 2,036 | 11.9 | 13.9 | 31.4 | 21.6 | 21.2 |
| Illinois | 13,413 | 1.8 | 6.2 | 30.3 | 30.1 | 31.6 |
| Mississippi | 1,174 | 19.1 | 31.4 | 30.8 | 6.9 | 11.8 |
| Massachusetts | 6,264 | 3.2 | 1.2 | 31.3 | 32.3 | 32.0 |
| Texas | 8,131 | 2.3 | 16.1 | 31.9 | 12.6 | 37.1 |
| Maine | 900 | 20.3 | 6.7 | 28.9 | 21.8 | 22.3 |
| Florida | 2,698 | 6.7 | 12.4 | 38.5 | 5.6 | 36.8 |
| Indiana | 5,035 | 3.4 | 9.4 | 27.0 | 36.7 | 23.5 |
| South Carolina | 1,411 | 11.8 | 14.6 | 28.5 | 29.6 | 15.5 |
| Arkansas | 1,278 | 12.8 | 30.2 | 30.6 | 7.6 | 18.8 |
| New Jersey | 6,691 | 2.4 | 2.1 | 28.9 | 36.8 | 29.8 |
| Tennessee | 2,550 | 5.7 | 12.0 | 32.3 | 22.6 | 27.4 |
| Minnesota | 3,366 | 3.5 | 17.5 | 30.7 | 16.9 | 31.4 |
| Idaho | 646 | 15.5 | 29.7 | 26.9 | 5.3 | 22.6 |

[1]26 states with income from timber products of $100 million or more, listed in decreasing order of magnitude.

## Summary

The annual output of raw timber products in the United States is calculated at $2.7 billion for the year 1950. Further manufacture into lumber, furniture, pulp and paper, wood chemicals, and other timber products adds $7.3 billion in value. Raw timber products are turned out mainly in the South (45 percent of the nation's total raw timber value) and on the West Coast (32 percent). The northern regions are low in raw timber output, high in manufactures. Their combined output represents roughly a fifth of the value of the nation's raw timber, but nearly half of the value added by timber manufactures.

Income payments to all individuals which are directly attributable to the production and manufacture of timber products—mainly wages and salaries and net profits—are calculated at $8 billion for the year 1950. This is 4.4 percent of the nation's total income of $182 billion from all sources other than government payments. It compares with $16 billion from farming (not including manufacturing based on farm-produced raw materials), $57 billion from trades and services, $45 billion from nontimber manufacturing, and $56 billion from miscellaneous sources.

Regionally, the South ranks first in income payments from timber products; the West Coast, second. The leading northern region—the Northeast—accounts for less than a fifth of the total income from timber products; but the Northeast, Lake, and Central regions combined account for substantially more timber income than does the South. In relation to the total regional economy timber income is most important on the West Coast, slightly less important in the South.

Income payments to individuals from timber products total at least $100 million in each of 26 states. Oregon ranks first among the states, followed by Washington, California, New York, and Michigan. Timber products provide more than 10 percent of total income other than government payments in 13 states.

## Symposium on Southern Silviculture

# The Case For Even-Aged Management of Southern Pine

**Robert D. McCulley**

North Coastal Plain Research Center, Southeastern Forest Experiment Station, Franklin, Va.

AT A MEETING of the Division of Silviculture, Society of American Foresters, Biloxi, Miss., December 14, 1951, a symposium on all-aged versus even-aged management of southern pines was held. The two papers by W. E. Bond and Robert D. McCulley are presented here in full since they best express the two viewpoints. Other papers have been digested in cooperation with their respective authors to highlight the more significant statements.

IT IS SMALL WONDER that opinions differ regarding most of the details of southern pine management or even that the proper silvicultural system may be in doubt. The southern pine territory is extremely large and diverse. It extends from Virginia to Texas, and from the mountains to the sea. The four major species of pine—longleaf, shortleaf, slash, and loblolly—differ quite markedly in their growth requirements. They occur with a variety of associated conifers and hardwoods on a variety of sites. Experience in one locality may lead to somewhat different conclusions from experience in another. And no management system, even-aged or all-aged, has been so thoroughly demonstrated in southern pine that we can know from definite records that it is superior to any other. There are basic facts and relationships, however, which apply in all localities, and it is on these facts and relationships that the case for regional application of a management system must be based. It is my purpose to present this array of evidence in favor of an even-aged system.

In doing so I make no pretense of speaking for any section of the South or even of promoting adoption of even-aged methods. We want in the South the best silviculture for our species regardless of what name it goes by. Periodic reviews such as this may help us to achieve that end by stimulating a reconsideration of the technical bases on which our local silviculture depends. It is in that spirit that this case will be developed.

The first requirement is a definition of even-aged management or at least some specifications for the system. The Society's publication *Forestry Terminology* defines an even-aged stand as one in which "relatively small age differences exist between individual trees." To make this definition apply to a system of silviculture requires the addition of a minimum area or stand size. For this discussion I am arbitrarily setting that unit at one acre to avoid any possible confusion with the group selection system.

### Longleaf Pine

To simplify the subject further, we should be able to dispose of longleaf pine in brief fashion and without serious argument because this species so obviously requires even-aged conditions for establishment of reproduction. Wahlenberg's conclusions regarding this point are given in the following quotation from page 255 of his book, *Longleaf Pine*. "No system that substitutes light and frequent partial cuttings for heavy seed cuttings and final harvests is suitable for the reproduction of an intolerant species like longleaf pine. Clear-cutting appears to be the best system for longleaf because the species must be reproduced in even-aged stands." Few southern foresters will dispute that conclusion. Any points made later regarding suitability of even-aged conditions for other southern species may therefore be considered to apply automatically to longleaf pine.

### Potential of Even-Aged Management

We can deal best with these other species by first considering what the advantages of even-aged management may be in well stocked and well-managed stands. In doing this we will be taking a look at the potential of the system as opposed to its practical present-day application.

Picture a stand of any of the major southern pines which seeded in promptly after a clear-cutting and has now grown to the age at which the owner wishes to harvest. Understory hardwoods may be of little significance because of site factors, they may be of small sprout size due to control measures applied economically on an area basis, or they may be larger, having been allowed to develop as best they could under the pine canopy. The overstory is pure pine or as nearly pure pine as the site will allow, and it is quite uniform. Partial cuttings for thinning, improvement, and salvage have left a final crop of trees of quality and size to suit the owner's needs. Well-developed crowns insure a good selection of seed bearers for the next step in management.

The stand is cut. Skidding of the large volume removed has rooted up the layer of leaves, pine straw, and grass to expose mineral soil on much of the area. If unmerchantable hardwoods are present, they too have been beaten down to some extent by the felling and many are rooted up in skidding. Perhaps a pre-logging area treatment with a disk or with fire has been added to improve the hardwood control and prepare the seedbed.

With these favorable conditions a seedfall should follow, sufficient on this high quality seedbed to yield a thriving stand of seedlings which grow at maximum speed in full sunlight to produce another crop and, if hardwood sprouts are present, to dominate them and keep them in the understory.

A deficient supply of seed will occasionally produce another result. In the absence of aggressive hardwoods, a simple delay occurs. Where hardwoods are more prolific, they may get such a start that later

good seed years threaten to be wasted. When this happens, release cutting or other treatment may be required to help the pine seedlings on their way. Then will come another round of cuttings for improvement, for salvage, and for thinning, leading to development of another mature stand similar to the one first pictured.

The variations on such an outline are many. Partial cuttings may be out of the question in some areas because of wet sites or limited markets. Soil disturbance may need to be cutailed on slopes. And there will be differences in minimum operable cuts which may range from 500 to 2,500 board feet per acre or from 1 to 8 cords per acre. The effect of type of ownership will also be marked. But in broad outline and somewhat idealized, that is the future even-aged silviculture in southern pine.

What are the significant features which make such a system applicable to southern pine? Of first importance are the silvical characteristics of our species, particularly during the regeneration period. The often repeated statement that "pine prefers mineral soil for a seedbed" certainly applies to the southern pines. In one locality loblolly pine seed requirement for an undisturbed seedbed have been found to be four to five times as great as they are for mineral soil. Evidence from elsewhere in the South indicates that some such differential as this is typical of loblolly and the other pines throughout their range. Not only does the maximum disturbance obtained during reproduction cutting in the even-aged system provide a seedbed of mineral soil as a valuable by-product, but if additional preparation of the seedbed is needed it can be done more economically and with a greater choice of methods than with any other system.

After germination, the new seedlings develop best in full light. For this reason, seedlings on clearcut areas where hardwood sprouts are abundant have an excellent chance to outgrow the sprouts if they get an even start. In partial light the reverse is true. Hardwoods reach their maximum photosynthetic rate at only about 35 percent of full sunlight, while pine must have nearly full light for maximum photosynthesis.[1] Furthermore, hardwoods inherently have lower shoot-root ratios than pine[2], and they attain a favorable shoot-root balance at much lower light intensity than does pine. As a result, at low light intensities the hardwoods also have a competitive advantage for moisture. Therefore under a canopy or in small openings they have every opportunity to beat out the pine.

When everything goes according to plan during the regeneration period, even-aged management provides ideal conditions for establishment of the new stand. But with any type of management there will be occasional failures in first-year regeneration. Where competing vegetation is a minor problem, these are temporary setbacks easily remedied by the next seedfall. However, where there is a build-up of competition from hardwood sprouts, loss of a year may result in a poorly stocked stand if something is not done. The remedy may be cleaning or release with hand tools or poisons, or it may involve complete rehabilitation of the seedbed. Such jobs are most efficiently planned and executed when a uniform treatment can be applied.

What of the economic aspects of such a system? Are serious deficiencies obscured by evident silvicultural advantages? Not so far as this non-economist can tell. On the contrary, costs of growing timber under this system should be relatively low. Stand improvement work of all kinds, concentrated in an area with uniform stand conditions, can be handled with the greatest efficiency. Mechanical devices or fire can be employed where needed for hardwood control or seedbed preparation as the trend toward use of labor-saving methods increases. Maintenance of roads should benefit to some extent from concentration of cutting. Fire protection, aided in some types by prescribed burning, should be economical. Management expense for timber marking, surveys for control, and supervision of cutting and other jobs should be at least in line with costs for other systems.

Also nothing we know of the even-aged system leads us to believe that the volume yield and quality of timber will be any less than the maximum the site can produce. Selection of individual stems for cutting at intervals during the life of the stand will permit salvage of mortality, concentration of growth on selected stems, and production of diameters and quality in accordance with the desires of the individual owner. The decision to harvest, soundly based on potential per acre yield, leads to a regeneration process involving minimum delay and with silvical factors working for rather than against the new stand.

### Second-Growth Stands

Thus far we have been discussing well-stocked and well managed stands. From that idealized version of the even-aged system let us turn now to its application to the varied conditions present in our second and third-growth stands of today. Their general irregularity when viewed from the car window suggests anything but the ideal situation about which we have been talking. And it is true that irregularity of distribution is the rule rather than the exception. However at close range and with one acre as a gauge of the minimum area required in one condition, we find that many stands are ideally suited to immediate application of even-aged silviculture.

These include the old-field loblolly and shortleaf pines throughout the South and the stands of slash pine in the Southeast. Less well defined but none-the-less even-aged are the blocks of premerchantable young growth which partly by design but mostly by accident have developed after removal of a previous stand. In the aggregate

[1] Kramer, P. J. and J. P. Decker. Relation between light intensity and rate of photosynthesis of loblolly pine and certain hardwoods. Plant Physiol. 19 (2): 350-358. 1944.

[2] Kozlowski, Theodore T. Light and water in relation to growth and competition of Piedmont forest tree species. Ecol. Monog. 19: 207-231. 1949.

these cover an extensive area. Then there is the area temporarily lost to low-grade hardwoods where regeneration with pine is the immediate problem as the first step in rehabilitation. Forest Survey figures show that every southern state has acreage of this class. Finally, there is the area bearing stands so badly depleted that regardless of what is done with the remnant of larger timber, the hope for continued production at a commercial level lies exclusively in regeneration.

Add the area in longleaf pine to that just described and we have over half of the commercial pine land in the South. Management of this area is not a simple problem. It requires commonsense and know-how and good business judgement, but the natural and compelling silvicultural techniques are those associated with the even-aged system.

The remaining acreage bears a miscellaneous mixture of reproduction, saplings, poles, and sawtimber usually in an understocked condition. It is on this acreage that even-aged silviculture meets its severest test because efforts to convert these stands to more uniform character quickly may result in wasteful cutting of young trees before their time. The desired course will be toward gradually reducing differences between groups, thus creating larger blocks of timber which can be treated uniformly. Ample time is needed for this conversion. It will be time well spent if the potential yield of the timber now on the ground is developed to the full extent possible without overlooking requirements for reproduction. We can be confident where this course is being followed that timberlands which have lost their natural even-aged character will be brought back to full productivity with little or no immediate loss in growing stock potential and with future maximum yields assured.

### Summary

To sum up the case for even-aged management, we claim the following advantages:

1. Every silvical character related to reproduction of the four major southern pines, without exception, is in harmony with the conditions prevailing where even-aged silviculture is properly used.
2. Under this system yields in volume and quality of pine are, so far as we know, maximum for the site.
3. Present conditions on the bulk of the commercial forest land in the South call for even-aged treatment.
4. Costs for marking, inventory, protection, road construction and maintenance, stand improvement, aids to regeneration, logging, and general supervision are more favorable for intensive management than under an all-aged system.

## The Case for All-Aged Management of Southern Pines

**W. E. Bond**
Southern Forest Experiment Station, New Orleans, La.

ALL-AGED MANAGEMENT employing the selection method of silviculture with single-tree and small-group cuttings is proving technically sound and profitable in commercial operations on several million acres of southern pine forests.

In presenting the case for all-aged management, I shall confine myself to one type—the loblolly pine-shortleaf pine and hardwoods. This type covers more area in the South than any other and occupies the better sites. I shall present as evidence facts and figures obtained in managing second-growth stands for sawlogs as the principal product. My evidence is based principally on results of 15 years of intensive but practical studies of selection management in the Crossett Experimental Forest and on surrounding commercial holdings. These second-growth loblolly pine-shortleaf pine stands are many aged. The site is not unusual—height at 50 years averages 83 feet. I shall discuss all-aged management under four headings: (1) the conversion problem, (2) silviculture, (3) protection, and (4) management.

### The Conversion Problem

When forest land is put under management, one of the first problems is that of deciding what cutting method to follow—all-aged or even-aged. The decision will depend in part on what the forests are like when management begins.

The Forest Survey (*10*) shows that the present unmanaged second-growth stands on pine sites often contain from 50 to 100 pines per acre ranging in size from a few inches to 20 inches, d.b.h. In southwestern Arkansas, about two-thirds of the total forest area is predominantly pine, and half of the pine forest is classified as saw timber. Stocking averages 3,400 board feet (International ¼-inch rule) per acre. Most pines in the region are under 15 inches d.b.h. and are, therefore, far from financial maturity. Cutting these trees in order to obtain an even-aged stand would sacrifice potential growth and income.

In 1950 a study was initiated at Canton, Miss., to compare costs and returns of converting the present second-growth forests of loblolly and shortleaf pines to all-aged and even-aged management. Four forties were set up. Each had stands composed of trees varying from new reproduction to 18-inch sawtimber trees; the average was 4,000 to 5,000 board feet per acre. To put them in an even-aged condition, two forties were clearcut. The average gross income per acre from sawlog, pole, and pulpwood stumpage from this clear cutting was $92. If these trees had been left for 5 years at present rate of growth, the gross value of the growing stock per acre would have been $164, even if there had been no increase in stumpage value per unit. This is an increase in value of more than $14 per acre per year.

and represents an earning of 12 percent compounded. I have yet to learn of any alternative investment of comparable risk where the money from the conversion cut can be invested at 12 percent compounded. Also, of course, these converted forties will yield no more income until the seedlings grow to pulpwood size—which will take at least 15 years. Unless even-aged management can show much greater returns on these clear-cut forties over the long pull, then all-aged management on the other two forties will pay greater net returns. It seems like very poor business to cut immature trees, which are increasing in value at the rate of 10 to 20 percent annually.

### Silvicultural Considerations

Let us next consider a few essential aspects of silviculture.

*Regeneration.*—Loblolly and shortleaf pines generally produce abundant seed crops at intervals of 3 to 5 years. On any given area, however, a considerable amount of seed is produced each year from scattered trees; probably enough to seed up small openings made in selection cutting. When seed years do not immediately follow clear-cutting, expensive planting of pine is required, or hardwoods take over. If hardwoods become a problem, a costly program of elimination must be undertaken, or these openings will remain unproductive and the age classes will be thrown out of balance. At Crossett, Ark. after 10 years of selection management, during which there was one good and one fair seed year, a survey of four randomly selected 40-acre tracts showed that 72 percent of the area supported 1,000 or more advance pine seedlings per acre (*6*). Considering that the area also had about 6,000 board feet of sawlog—and a good stand of pulpwood-pine growing stock, it is evident that the pine reproduction was adequate. Another study (*3*) after a third excellent seedfall in 1947-48 on the good farm forestry forty showed a catch of 7,500 seedlings per average acre, in spite of the fact that 88 percent of the total area was effectively occupied by advance reproduction, saplings, poles, or sawlog-size trees (8,000 board feet per acre). This tract had not been burned for 15 years and litter depth averaged 1.3 inches. Even on areas covered with logging slash, where the litter was 2.6 inches deep, 1,300 seedlings per acre were established. The study was made in August, following a 4-weeks' drought, so it was an especially good test of whether seedling establishment can be obtained under selection forests without recourse to burning or other methods of seedbed preparation.

What about survival of these seedlings? Studies at Crossett show that if seedlings happen to occur directly under a dense low pine or hardwood overstory, they are almost certain to die at an early age. They can be saved by cutting or killing the hardwoods. They are not needed if they are growing under immature pines of good quality, as it is far more profitable to concentrate growth on trees larger than seedlings. Under a high pine overstory, if there is enough light from the side, pine seedlings and saplings will grow within 3 to 5 feet of the bole of the large trees. In some stands with 10,000 board feet per acre there are young trees now 30 to 40 feet high and still growing as much as 2 to 3 feet per year.

A detailed study (*11*) of effect of size of openings of forest canopy showed that even in openings that were 15 to 30 feet wide and surrounded on all sides by a solid wall of large timber, survival 5 years after seedfall was 8,000 seedlings per acre with an average height of 2.6 feet. The seedlings had a minimum of limbs and were developing satisfactorily. This opening represents the minimum size that would be left by single-tree selection cutting. Usually more light would be available from the side, since normally younger age classes would occur adjacent to a group of large trees and seedlings would be stimulated to more vigorous growth. This study and actual practice at Crossett show conclusively that natural regeneration, with satisfactory survival and growth of seedlings, is no problem with selection cutting.

*Comparative yields.*—Comparative yields, measured in volume and quality of products, are not available from all-aged and even-aged management. However, some idea of productivity of second-growth loblolly pine-shortleaf pine stands can be obtained by examining some results compiled after 10 years of selection management on 1,000 acres of the Crossett Experimental Forest (*4*). These stands have increased 30 percent in pine volume, from an average of 4,800 to 6,250 board feet even though 37 percent, or 1,760 board feet per acre, was harvested during the period. The number of pine trees over 12 inches d.b.h. has increased by 20 percent and the number of pines over 20 inches by 60 percent. The period of management has not been long enough to demonstrate what volume of stocking is optimum. The 1951 inventory of the good farm forestry forty showed an average volume of about 10,000 board feet and an annual increment of about 700 board feet per acre. This indicates that the 1,000-acre tract should still be built up considerably in volume of large high-quality saw-timber trees.

In normal even-aged forests an equal area is occupied by each age class. Our experience in building up stocking of all-aged stands indicates that these stands can be maintained with ample regeneration and recruitment when the older age classes occupy more area than the younger age classes. With side lighting, seedlings, saplings and small poles are being grown under sawtimber trees and in this way larger percentages of the productive capacity of the land is available to and going to the large high-quality trees. This trend is in agreement with experience of Swiss foresters with all-aged management (*1*). On these areas where roots of large and small trees share varying levels of the soil and trees of varying heights spread their needles in different layers of the atmosphere the all-aged forest ap-

parently utilizes the site in producing wood more efficiently than would an even-aged forest. With selection cutting the wood increment is concentrated on the finest individual stems. Such cutting removes the poorer sawlog trees to free high-grade poles but carries the better sawlog trees to financial maturity. At rotation age all trees cannot be of the same size and quality in even-aged stands but must be clear cut whether financially mature or not. Some stands, in which storms, accidents, or delayed regeneration have interfered, will reach rotation age depleted and irregular, with many poor-quality trees that necessarily had to be retained as soil cover.

*Hardwood control.*—Controlling less-valuable hardwoods in pine hardwood stands has always been and probably always will be a silvicultural problem in the South. It is common to both all-aged and even-aged management.

A special study (7) of the hardwood problem by the Forest Survey showed that in 1949 almost half of the 5 million acres of potential pine sites in southwestern Arkansas were adequately stocked with pine. On this half about 20 percent had little or no hardwood problem. On the half inadequately stocked with pine, only 6 percent was practically free of hardwoods; 8 percent had an over-story of small hardwoods which fire could kill back to the ground; and 86 percent had hardwoods over 2 inches in diameter which prescribed burning would not kill. Evidently controls more effective than fire are required here.

There is no quick and easy way to get rid of the hardwoods. Fire, often offered as panacea for controlling hardwoods in even-aged management, has not yet been thoroughly tested. It is costly and impracticable when used on small areas under either even-or all-aged management. Well-accepted techniques of girdling and poisoning hardwoods, however, are effective. Hardwoods 2 inches in diameter and larger can be poisoned with Ammate and adequate stocking of pine obtained for an average cost of about $4. per acre. The increased growth of pine has more than paid for this cost within 10 years (*4*). The biggest reward comes from releasing merchantable or near merchantable pines, but it pays also to release younger pines. Most stunted and slow-growing overtopped seedlings respond immediately to release.

We have made no attempt to reduce hardwood brush. Nevertheless after a dozen selection cuts and with complete exclusion of fire, only 4.5 percent of the total area of the good forty and 1.7 percent of the poor forty are occupied by hardwood brush to the exclusion of pine. Generally the pine has grown up through the brush.

## Protection

It is generally agreed among foresters, entomologists, and pathologists that all-aged, mixed forests, are safer from fire, wind, ice, insects, diseases, and other destructive agencies than are artificial even-aged forests (*2*).

In southern pine, fire is generally rated as enemy Number One. Fire in young even-aged loblolly or shortleaf pines is completely destructive and, once out of control, can seldom be stopped before the whole stand is destroyed. In one bad fire season, a 10-year age class—even though it occurs in several blocks—can be wiped out over a large territory, and area-regulation seriously disrupted. Where reproduction is restricted to small openings, not continguous but scattered in small groups over large areas, fire is much more easily controlled. Furthermore, if fires destroy groups of seedlings in all-aged stands, there is available an abundance of pine seed to regenerate these burned areas immediately before hardwoods sprout and take over.

Large holdings of many-aged southern pine forests are now efficiently protected with the burned acreage held below 1 percent of the area protected for an annual cost of 4 cents per acre. Of this 2 cents is paid to the state for fire protection and the other 2 cents is spent for extra fire lines and suppression during emergencies (*8*). For even-aged stands the same state detection and suppression force would be employed. In addition very intensive protection of seedling and sapling stands, and prescribed burning to reduce hazard, control hardwood brush, and prepare a seedbed at final harvest would probably boost total costs beyond those for all-aged management. The value of growth and growing stock lost in prescribed fires must also be considered.

Disastrous insect infestations and widespread losses from tree diseases occur when the biotic balance of a forest is disturbed. Improper cutting, forest fires, and unnatural succession often produce a very high percentage of the most suitable food trees for some insect pest, and reduce environmental resistance by decreasing the natural enemies. Hosts for diseases may likewise be greatly increased. The brownspot disease of longleaf pine and the heavy infections of planted trees by the fusiform rust are warnings that foresters cannot afford to overlook. Certainly all-aged forests of mixed species are our best insurance against these pests and against ice and wind damage.

## Profitable Management

We have practiced profitable selection cutting on 1,000 acres of the Crossett Experimental Forest for 15 years (*9*). Each 40-acre compartment is cut periodically. The volume of cut is held below the increment, because optimum stocking has not been reached, and percentages of volume in the larger size classes are being gradually increased. The cut removes financially mature crop trees (those that no longer increase in value fast enough to earn a satisfactory rate of return) and those trees that need to come out to improve growing conditions and quality of the growing stock. At 1949 stumpage prices, the gross income from stumpage harvested during the first 10 years averaged $5.90 per acre per year. Each year, in addition, a volume of stumpage worth $2.10 per acre was added to the growing stock. With the average

log 15 inches d.i.b. (109 board feet) and 45 percent of volume in Grade 1 logs, logging costs were low and stumpage values were high. The total cost of intensive management was 75 cents per acre per year, but this included 22 cents for road depreciation and maintenance in addition to the usual costs of taxes, protection, cultural operations, and supervision.

The gross and net returns are being increased each year as the volume and quality of the growing stock is being built up towards optimum stocking. In 1951 the annual cut of sawlogs and pulpwood on the good farm forestry forty, where the growing stock is 10,000 board feet per acre, had a stumpage value of $14.75 per acre, but the cut took less than two-thirds of the saw-timber increment. We are certain that a cut from well-stocked all-aged stands at 5-year intervals would yield between 2 and 3 M board feet and that at least two-thirds of the volume would come from trees 20 inches d.b.h. and larger. Such high-grade timber would yield large percentages of valuable high-grade lumber, and logging costs would be at a minimum. It is believed the net annual income per acre from sawlog, pole, and pulpwood stumpage would average over $20.

Without conclusive evidence from both all-aged and even-aged management, we have only our experience on which to base judgement. It seems clear to us, however, that with more flexible volume regulation, all-aged management will produce larger volumes of more valuable products at less cost than can even-aged management with more rigid area regulation. Furthermore all-aged stands can more profitably meet the requirements of current markets, for cuttings come from larger areas on which more trees of many sizes are available. Climatic and man-caused calamities also can be met with less economic loss.

### Recommendations

After 28 years of forestry experience in the South, including over 20 years of managing small forests of my own, and after many years of close contact with studies of financial aspects of selection cutting, I recommend all-aged management as technically practicable and financially profitable for loblolly pine-shortleaf pine forests growing on reasonably good sites. I strongly recommend against drastic changes of uneven-aged stands of any southern pines, which sacrifice potential income, until more evidence is available that evenaged management in the long run is economically, silviculturally, and ecologically sound. Much experience with even-aged management in European countries over several centuries is discouraging.

It is conceivable our species and conditions are such that neither system can be proved superior. In that case each stand, as a unit, would be managed according to existing stand conditions, and no doubt some foresters would define this as all-aged and others as even-aged management.

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# Silviculture of Southern Pines from the Standpoint of Integrated Utilization of Products


**George A. Anderson**

Brunswick Pulp and Paper Co., Brunswick, Ga.



SUMMARY: The author points out that one of the first goals of forest management should be to increase the growing stock to a level that will sustain high yields. Before attempting to mold a forest into the desired form to obtain high yields, he contends that it is imperative to become intimately acquainted with the forest and its physical and economic environment.

In the longleaf pine and slash pine types experience indicates that a program of protection from fire closely coordinated with an intelligently supervised prescribed burning program will produce a forest of the most desired form. A combined program such as this can be carried out only in an even-aged forest. This coupled with the fact that longleaf pine is very intolerant, and the ease with which slash pine becomes established resulting in even-aged stands, makes the choice of even-aged silviculture an easy one.

The author states that the objection to even-aged management from the standpoint of irregular income for the owners of small forest acreages is unfounded. He points out that annual incomes from selective turpentining when added to income from thinnings and improvement cuttings would provide greater returns than these

landowners have obtained in the past.

The author presents a plan for the gradual conversion of pine types in unmanaged forests to sustained yield using even-aged silvicultural systems. The practices advocated under these systems can most easily integrate selective turpentining, pulpwood production, pole and sawlog production into one system of management.

## Silviculture of Southern Pines from the Standpoint of Growing Sawlogs

**T. R. Moberg**

Forester, Ozan Lumber Company, Prescott, Ark.

SUMMARY: This paper was in part an explanation of excellent Kodachrome slides which the author used in his talk but which cannot be reproduced in the JOURNAL. "Before" and "after" pictures were shown simultaneously to bring out the effect of release from hardwoods on the growth and development of pine seedlings. Based on over eight years' experience with the predominantly mixed, second-growth shortleaf pine-loblolly pine-hardwood forests of southwestern Arkansas, the author concludes that pine and hardwoods can about equally create modified environments that are favorable to each other. With good protection from fire hardwoods are developed having much better quality, form, and growth rate, than the present sawlog-size trees that did not have the benefit of fire protection and management.

Also, abundant advance reproduction of pine occurs under the medium to larger size hardwoods. Following release from overtopping hardwoods the understory pines recover and again become healthy, normal trees. Where girdling operations are in progress and are aimed at the removal of low quality hardwoods, below sawtimber size, only those trees are treated which are overtopping pine seedlings.

The author advocates that pure pine stands in southwestern Arkansas should be eventually converted to mixtures of pine and hardwoods and that these mixtures be managed under the selection method as uneven-aged stands.

## Comments on Southern Pine Silviculture

**R. H. Westveld**

Department of Forestry, University of Missouri, Columbia.

IN ATTEMPTING to evaluate the evidence that has been presented we should remember that the discussions have centered on several sound basic theories, a few facts, and numerous opinions—the latter based on careful observations and years of experience in actual timber management by each of the speakers. The advocates of uneven-aged management have the advantage in the quantity and variety of their factual information since the development and maintenance of uneven-aged stands was the goal of the first research on southern pine silviculture. Only recently have facts from research become available on even-aged management, chiefly on regeneration of the pines in even-aged stands. Until more facts, secured over a longer period of time, are available, the controversy over southern pine silviculture will continue to be waged on theoretical grounds and the opinions of individuals, the latter often warped by bias. The speakers developed four points in their discussions which seem to provide a sound basis for comparing the relative merits of even- and uneven-aged management. These were (1) effectiveness in maintaining the most desirable stand composition, (2) effectiveness in producing maximum volume and quality of timber, (3) effectiveness in developing stand conditions which minimize the protection problems, and (4) effectiveness in creating conditions for most economic harvesting operations. When research can provide information on all of these points for both even- and uneven-aged management, we will be closer to solving the management of southern pine stands.

The chief controversy over management is concerned with the loblolly pine-shortleaf pine type. On the other hand no one seems to question the desirability of even-aged

## Comment

**S. V. Sihvonen**

Manager, Forestry Division, Crossett Lumber Co., Crossett, Ark.

I HAVE HAD many discussions with Dr. Chapman on the use of fire in the management of loblolly and shortleaf and the desirability of managing those species by an even-aged system. We have at Crossett a young second-growth forest on which we are endeavoring to improve the stocking. To achieve this we are using all types of cutting practices even though our ultimate goal is an even-aged forest. We already have considerable areas of even-aged stands produced by leaving seed trees and burning the slash. We are creating other large areas of essentially even-aged stands with our cull timber removal program. Fire is also being used by us for this purpose on an expanding scale. Even though our aim is for even-aged forest, our need to produce a flow of raw materials makes it necessary for us, in the meantime, to use various silvicultural systems. It will probably be a long time, possibly 50 or 60 years, before our forest-wide even-aged management goal can be reached.

management for slash or longleaf pine. Possibly there is no single system of management which will give optimal results for the diverse ecological and economic conditions that exist over the vast area where loblolly pine-shortleaf pine forests grow. Research with an unbiased thorough approach can eventually give the answer.

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## Stand Density and Growth

**F. S. Baker**
Professor of forestry, School of Forestry, University of California, Berkeley.

EVERY FORESTER REALIZES that stand growth depends upon proper density. In a young stand or new plantation, too few trees to promise an early true occupancy of the land area bother his sense of adequacy. Later, the presence of crowding makes him sure that a thinning is needed to reduce stand density and bring about good growth. The writer has found much to convince him of the excellence of this viewpoint. However, he has learned that foresters are surprisingly vague about drawing a line where trees are either too few to utilize the acre properly, or when the numbers are so high as to make the need of thinning absolutely clear.

This situation is one of much current interest, and numerous publications in this country, as well as in Europe, indicate a growing emphasis upon the study of "density" — its measurement and significance. Some of the confusion and study results from the concepts of forest growth and development that are employed. Some investigators confine themselves to "merchantable" products — obviously variable with markets. Others deal with net increments — eliminating death losses. Still others are concerned with gross increments — the total bole growth of the whole stand.

In view of this situation, the writer became interested in a situation where about 30 years ago ponderosa pine suddenly invaded an overgrazed grassy flat near the north edge of Meadow Valley, an area on the Plumas National Forest in northern California. Close to the parent stand, edging the grassland, the invasion was heavy and today, after 30 years, it presents a picture of a poor stand of pine—crowded, dense, and promising little to the forester in the large number of inferior, slow-growing trees. Farther from the forested hills the seeding was less effective, and the less dense stand looks far better. The invasion finally ends with scattered individuals or small groups in which the leading tree is long-crowned, straight, and thrifty, but where too much grassland still exists to allow a forester to think that much production per acre actually exists. This area appears definitely like a piece of ponderosa forest land too dense on one hand, too open on the other, fortunately even-aged, and luckily still free of mortality.

Because of its general appearance, this area was carefully examined and several fairly uniform areas representing different degrees of density were found. In addition, an area loosely covered with truly scattered individuals or small groups yet more distant from the parent seed trees was also sampled. These areas were sampled in the spring of 1950, when diameter, height, and tree location were recorded for all trees; and increment borings were taken at breast height for most of them. From these data the increment of each tree was computed so that growth per unit of area could be determined with fair accuracy. In this work, the annual growth of the bole was assumed to be the layer of wood laid down the year before, and that it was as thick as that obtained by the increment boring at breast height on all parts of the bole. No height growth for the single year was assumed, and a form factor of a little less than .40 was assumed to exist in all trees, as that figure simplified computations. Since all data were used for comparative purposes only, and not for actual volume increment, further refinements were necessary.

The plots are small and the results are, therefore, not too valuable. However, they do indicate certain trends that are perhaps too frequently overlooked, and which need careful consideration in any work dealing with the interrelation of density and growth, particularly when it involves a stand in which the mortality factor can be ruled out.

### Total Wood Production per Unit of Ground Area

The results which appear in Table 1 show that the wood production per acre of Stands A and B changes too little to be clearly demonstrated, although density varies from 2,152 to 214 trees per acre. The irregular wide-spaced stand is difficult to interpret; but the growth per acre appears to be definitely low, although the individual stems have grown generally fast. The results show clearly

TABLE 1.—RELATIONS BETWEEN DENSITY OF STOCKING AND VOLUME INCREMENT OF BOLES PER ACR

| Area sample | Area | Trees per acre | Mean spacing | Mean d.b.h. | Growth per acre | Growth per tree | Basal area per acre |
|---|---|---|---|---|---|---|---|
| | *Acres* | *Number* | *Feet* | *Inches* | *Cu. ft.* | *Cu. ft.* | *Sq. ft.* |
| A-1 | .0895 | 2,152 | 4.5 | 4.3 | 69.4 | .032 | 2.6 |
| B-1 | 0.757 | 1,330 | 5.7 | 5.3 | 64.1 | .048 | 212 |
| A-2 | .0689 | 858 | 7.1 | 6.0 | 54.0 | .063 | 202 |
| B-2 | .0757 | 663 | 8.2 | 7.4 | 86.8 | .131 | 215 |
| A-3 | .1263 | 428 | 10.0 | 5.6 | 52.8 | .123 | 182 |
| A-4 | .1078 | 214 | 14.0 | 7.7 | 62.0 | .290 | 129 |
| Grouped | 10± | 12± | ... | 10.4 | 5.6 | .467 | 8.7 |
| Single | 10± | 12± | ... | 12.4 | 5.6 | .467 | 8.7 |

TABLE 2.—DISTRIBUTION OF TREES: PERCENTAGE BY NUMBERS IN EACH SIZE CLASS AND PERCENTAGE OF STAND INCREMENT BY SAME CLASSES

| Area sample | Small[1] | | Medium[1] | | Large[1] | | Very large[1] | |
|---|---|---|---|---|---|---|---|---|
| | No. | Incr. | No. | Incr. | No. | Incr. | No. | Incr. |
| | *Percent of total for area sample* | | | | | | | |
| A-1 | 76 | 27 | 23 | 64 | 1 | 9 | 0 | 0 |
| B-1 | 54 | 12 | 42 | 67 | 4 | 21 | 0 | 0 |
| A-2 | 46 | 12 | 53 | 81 | 1 | 7 | 0 | 0 |
| B-2 | 24 | 2 | 56 | 52 | 20 | 46 | 0 | 0 |
| A-3 | 29 | 5 | 51 | 45 | 18 | 42 | 2 | 8 |
| A-4 | 10 | 1 | 37 | 11 | 33 | 51 | 20 | 37 |
| Grouped | 9 | 2 | 27 | 17 | 52 | 43 | 12 | 38 |
| Single | 0 | 0 | 22 | 8 | 38 | 33 | 40 | 59 |

[1]Small trees = 2 to 5 inches d.b.h. Medium trees = 6 to 9 inches d.b.h. Large trees = 10 to 13 inches d.b.h. Very large trees = 14 inches and larger.

enough that the forester's accepted concept about "growth" as related to density is difficult to establish. Stand A-1 looks miserable with dense patches of small trees, some too poor to stand straight under snow pressure, and few appearing to have much promise. Undoubtedly mortality in a few years will start to reduce net increment. Basal area is high; height growth is low but the upshot of the complete coverage of crowns is a good gross growth-per-acre figure.

On the other hand, Stand A-4 at the other end of the scale looks good. The dominants and codominants are thrifty looking; their crowns are large and dominate the area fairly completely. Although some suppressed individuals are going to die soon, the stand looks promising.

The area where scattered individual trees or scattered tight groups exist is less easy to interpret; it is not a true "stand." Note that a growth per acre of 60 cubic feet (the rough average of Stands A and B) could be attained with 130 trees of average growth rate per acre. This would mean that each tree occupied 335 square feet of ground area or a circle of 20 feet diameter. This is actually about the average maximum crown diameter of the mean trees of this group, which encourages the idea that as few as 130 trees per acre might still maintain the same gross bole increment per acre.

The net results here indicate that for ponderosa pine on this site, densities from 130 well-spaced trees to 2,000 trees naturally-spaced yield virtually the same gross annual increment at an age of 30 years.

## Growth as Related to Size Classes

Actually, however, the forester's viewpoint, while it may be technically erroneous in the matter of total gross increment per acre, does have an excellent realism from the standpoint of net productivity of merchantable products. The acres stocked with many trees are likely to suffer heavy mortality soon, and sawlogs are going to be produced only slowly.

The larger trees are the valuable stand members, because they are growing individually well and are not going to die. The gross growth of the small trees is large only because of their immense numbers per acre. The chances of transforming this growth into useful wood is remote indeed. Even though wood production per acre is virtually independent of density, there is a true difference in size development and merchantability, which properly worries the forester. Too much wood in the denser stands will have to moulder away unsold; too much will have to be sold cheaply as small saw timber to bring in much cash income. The situation is clearly indicated in Table 2 where it is very evident that the more densely populated areas carry high percents of small trees whose gross increment is low and which offer virtually nothing for the future. The percents of large trees by number run low but the increment runs high at the same time, and mortality of these trees is far in the future.

TABLE 3.—INCREMENT PER TREE BY DIAMETER CLASS EXPRESSED IN CUBIC FEET OF BOLE WOOD INCREMENT

| D.b.h. | Volume growth per tree by density areas | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | A-1 | B-1 | A-2 | B-2 | A-3 | A-4 | Grouped | Single |
| 3 | .007 | .007 | .007 | .004 | .007 | | .025 | ... |
| 4 | .015 | .012 | .013 | .011 | .015 | .031 | .033 | ... |
| 5 | .029 | .019 | .025 | .018 | .031 | .055 | .044 | ... |
| 6 | .046 | .042 | .041 | .045 | .053 | .084 | .080 | .138 |
| 7 | .080 | .075 | .053 | .076 | .083 | .125 | .095 | .177 |
| 8 | .130 | .123 | .105 | .123 | .120 | .188 | .158 | .207 |
| 9 | .197 | .190 | .178 | .160 | .163 | .276 | .212 | .320 |
| 10 | .287 | .156 | .230 | .205 | .214 | .366 | .276 | .432 |
| 11 | ... | .339 | ... | .347 | .275 | .442 | .420 | .500 |
| 12 | ... | ... | ... | .400 | .344 | .525 | .386 | .567 |
| 13 | ... | ... | ... | .670 | .421 | .620 | .503 | .762 |
| 14 | ... | ... | ... | ... | .512 | ... | .597 | .773 |
| 15 | ... | ... | ... | ... | ... | ... | .639 | .884 |
| 16 | ... | ... | ... | ... | ... | ... | .670 | .883 |
| 17 | ... | ... | ... | ... | ... | ... | 1.037 | 1.220 |
| 18 | ... | ... | ... | ... | ... | ... | ... | ... |
| 19 | ... | ... | ... | ... | ... | ... | ... | ... |
| 20 | ... | ... | ... | ... | ... | ... | ... | ... |
| 21 | ... | ... | ... | ... | ... | ... | ... | 1.487 |
| 22 | ... | ... | ... | ... | ... | ... | ... | 1.876 |

TABLE 4.—HEIGHT OF TREES BY DIAMETER CLASSES IN THE DIFFERENT DENSITY AREAS

| D.b.h. | A-1 | B-1 | A-2 | B-2 | A-3 | A-4 | Grouped | Single |
|---|---|---|---|---|---|---|---|---|
| 4 | 18 | 20 | 18 | 18 | 19 | 18 | 13 | ... |
| 6 | 22 | 25 | 23 | 25 | 23 | 21 | 17 | 12 |
| 8 | 26 | 28 | 26 | 28 | 26 | 24 | 21 | 16 |
| 10 | 28 | 31 | 27 | 31 | 28 | 27 | 26 | 20 |
| 12 | ... | ... | ... | ... | 30 | 30 | 30 | 26 |
| 14 | ... | ... | ... | ... | 32 | ... | 34 | 30 |
| 16 | ... | ... | ... | ... | ... | ... | 38 | 34 |
| 18 | ... | ... | ... | ... | ... | ... | ... | 38 |

### Individual Tree Growth in Diameter

The difference in rate of diameter growth at 30 years is further illustrated by the figures presented in Table 3. Regardless of density, the growth of the small trees (due largely to grouping) is small; but, as the density decreases, the number of primary trees increases, and the realistic picture of growth and of time to reach merchantability is greatly changed.

### Height Growth as Related to Density

On deep-soiled, flat land such as represented here, site quality is not reputed to vary, and foresters normally expect uniformity of height growth. Again, however, the belief is growing that especially in young stands, density affects height growth. So it appears here, although the variation is hard to understand and explain. The essence is shown in Table 4. In Stands A and B there is some indication that stands in Group B are on a slightly better site, as growth of the better trees is somewhat greater. The differences resulting from variation in density are small and of doubtful significance (partly because of inaccuracies in hypsometer use).

The open grown trees, both single and grouped, are more significant. The best of the trees are definitely taller than those in the stands, apparently because of the freedom from competition. This freedom, as shown in Table 2, produces trees far larger in diameter and somewhat superior in height growth. When we descend to the diameters met with in the closed stands—as from 10 inches downward, the open-grown trees are inferior in height. The accepted explanation is that competition stimulates height growth. However, this may not be all that is involved. The small isolated and grouped trees have very often been unlucky in their earlier years, having been browsed, trampled, or otherwise injured by the cattle that graze the area. All that can be claimed for the material in Table 4 is the completion of a realistic picture of the situation.

### Summary

The whole lesson appears to be this. Growth in a biological sense is not much affected by variation in common densities (trees-per-acre); but in an economic or business sense it is profoundly so affected. The degree of effect is more a matter of products, markets, and prices than anything the biologist can ascertain in computations of gross increment.

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## William K. Beichler (1902-1953)

William K. Beichler of Garner, N. C., former state forester of North Carolina, died of a heart attack on January 5.

Born October 2, 1902 in Philadelphia, Pa., Mr. Beichler attended Pennsylvania State College, receiving the degree of Bachelor of Science in forestry in 1925. During that year he entered the U. S. Forest Service as junior forester on The Pisgah National Forest, and in 1927 was appointed district forester in the North Carolina Forest Service. Appointed assistant chief of state fire control in 1936, he was advanced six years later to the position of assistant state forester in charge of fire control.

In 1945 Mr. Beichler was appointed state forester of North Carolina and served until 1951, when he was dismissed by the director of the Board of Conservation and Development. Following this action the Board's forestry committee, which was not consulted concerning the dismissal, adopted a resolution which stated in part: "The Committee regrets that this action means the loss to North Carolina of a faithful, intelligent, and honorable public servant with more than 25 years of loyal service to the state."

Elected a Junior Member in the Society in 1930, Mr. Beichler became a Senior Member in 1934. He was a past chairman of the Appalachian Section, and had long been active in the North Carolina Forestry Association.

# Drafting Timber Sale Contracts From a Forester's Standpoint[1]

**Ray A. Yoder**
Assistant professor of forest management, Oregon State College, Corvallis,

*Proper handling of the sale of standing timber requires a combination of technical forestry, logging engineering, economics, law, and horse sense. Too often beautifully-written legal documents fail to achieve the forester's purposes, or contracts which are meant to result in excellent forestry are found to be unenforceable. Recognizing the importance of the attorney's role, the author discusses this vital topic from the viewpoint of a forester administering sales and attempting to use the tools of the law for proper control and direction of cutting.*

DRAFTING TIMBER SALE CONTRACTS must assume a division of responsibility between the forester and his legal counsel. Since each may have only scant knowledge of the other's field, it usually behooves the forester to gain sufficient familiarity with such law as pertains to timber as will enable him to be a "copybook attorney." With this knowledge, he can draft the "forestry" portions of the contract himself, then submit it to the attorney for his review, correction, and expression in standard legal phrases. This method is usually time-saving. The other alternatives consist of either submitting all the pertinent information to the attorney and awaiting his draft (often resulting in an unrealistic contract), or sitting down with the attorney and jointly drafting the instrument. The latter method is not ordinarily fruitful, since it is usually necessary to inform the lawyer of forestry matters and woods jargon while so doing.

Though the work of drafting the instrument is usually a top-level responsibility, the forester entrusted with the job should recognize that much of his best information can be obtained from his associates who are actively engaged in field inspection for contract compliance. Their familiarity with field conditions and operations (including the personnel involved) makes them invaluable sources of information and advice.

Three major considerations which should govern the actions of the forester in the negotiations preliminary to writing the contract are: (1) his objectives, and the means by which they may best be achieved, (2) how attractive the proposition is from a contractor's viewpoint and, (3) how well the contractor is qualified to carry out the terms of the contract to a conclusion satisfactory to both forester and contractor.

Several alternatives are open to the forester in arranging for the cutting of timber from lands under his jurisdiction. On the timberlands owned by his employers, the choice of which method to use should be made after determining how well each will serve in achieving management objectives.

For purposes of comparison, let us pose a hypothetical situation and see how each of the alternative methods functions, or fails to function, in obtaining the performance desired:

A forest property includes 3,000 acres covered with low-value hardwoods and a mixture of valuable conifers. The principal management objective is to get rid of the hardwoods and increase the stocking of the conifers. Cash income is desired, but is secondary to the main purpose. The hardwoods alone do not offer an attractive operating proposition to a purchaser.

One possibility is to hire a logging crew to do the job under the direction of the forester and his associates. This method provides for the ultimate in control of the operation, but is often economically undesirable for reasons beyond the scope of this article.

Another means at hand (and one commonly attempted) is to sell all the hardwoods, together with enough of the coniferous stumpage to make the operation profitable. Title is conveyed by means of a timber deed. The principal weakness of this arrangement comes from the fact that the new owner can do as he pleases with the timber to which he now holds title, up to the time limitation granted for cutting and removal. Unless he wishes to remain in the good graces of the seller, in which case he may do a passable job, he can high-grade to his heart's content. Real control of cutting is lost.

A third method in wide use is that of contracting with a logger for the cutting of the timber, but keeping title in the landowner. If the contract is properly drawn, the control measures are in the contract itself. With proper supervision of the operation, the contract usually serves its purpose.

The last alternative consists of entering into a timber sale contract which provides, among other features, for the purchaser's performance in conformity with the stated objectives of the seller. The timber is paid for as cut. The chances of obtaining a good job are practically identical with those of the previous method, except that the purchaser has an added economic risk in the form of the market for the logs, which feature may make strict contract compliance more difficult on a falling market.

Each of the above is a clear-cut case. The question of possible combinations of these devolving from the issue of the point in time at which title passes, or the matter of varied interpretation of timber sale contracts in certain of the states, may be answered only by reference to the laws that there apply. It should also be understood that a different basic set of circumstances might well lead to selection of a different alternative from those discussed.

[1]The author wishes to state that nothing included in this article should be construed as advice of a legal nature. The material has its origin in timber sales work, discussion with others in similar work, and in numerous consultations with attorneys while dealing in such matters.

We will assume that the forester has laid out his operating area and has decided upon a logging plan. At this point he is ready to begin negotiations with a reliable local operator who is reasonably solvent. We shall also assume that he has decided to have the area logged by either of the latter two alternatives recited above. Following is a list of points (within the forester's area of responsibility) to be included in the contract, together with comment on some aspects which deserve emphasis.

### The Selling or Contract Price

The contractor is in business for profit. If the price is set too high, or if the amount paid for logging the timber is too low, he may refuse to enter into the contract. If he undertakes the job under either of these circumstances, the results are usually disastrous—the work is poorly done in an effort to make a profit, or the contractor works at a loss. There is no material advantage to be gained in the long run in enforcing such a contract. To do so will create enemies, disrupt plans, and increase later costs, to say nothing of the burden it will place upon the personnel responsible for contract supervision.

A fair price arrangement used by many firms is to tie the price to one or more of the variables that affect the operator's costs of production such as labor or log prices, so that the price paid for the timber, or the amount paid for logging it will increase or decrease in direct proportion to the weight of each of these variables in determining costs and profits.

The price should be stated per unit of measure, and the log rule (or other unit) should be fully and clearly defined.

### Legal Description of the Land

The principal requirement is that the land be described with such a degree of accuracy as to render it precisely identifiable. Accurate descriptions can ordinarily be obtained from the deed or other conveyance by means of which the seller acquired title. In view of the importance of correctly describing the land, all such descriptions should be triple-checked for accuracy. Metes and bounds descriptions should be platted. In a recent case which came to the writer's attention, the owner of 80 acres of old-growth Douglas-fir timber was under the false impression that he had included it in a sale of adjoining timber. The same impression was held by the purchaser of the adjoining timber, who thought that the "80" was included in his timber deed. The logger who contracted the cutting was also in error as to this point. All three had identical copies of the description which did not include the 80 acres in question.

### Legal Description of the Timber

The requirements for accuracy in describing timber are as important as those for identifying land. As in the case of land descriptions, there are several means whereby the timber may be described adequately. Depending upon the nature of the operation, any one of the following methods may be used:

*By species.*—It is necessary to use species names which have only one generally accepted meaning, or to define the meaning of the names used. For example "Douglas-fir" has only one generally accepted definition among Pacific Coast lumbermen, but the various age-classes of the species and the wood properties found in various trees or stands bring into use such terms as "second growth," "red fir," "old growth," "yellow fir." Unless such terms are defined, they fall short of being sufficiently exact.

*By size.*—Since the diameter at the stump is the only measurement which can be made with any degree of precision after the tree has been cut and removed, it should be the only size specification used. Any others, such as d.b.h. height or crown class, will lead to controversy. Specifications as to stump diameter should include the height above ground at which the measurement is made, and should recite whether or not the bark is included.

*By marking.*—Paint marks or stamped blazes on the trees are sufficient description of the timber, if the contract specifies the exact identification used. Marks should be duplicated on the base of the tree below stump height.

*By suitability for certain uses.*—If the sale or logging contract contemplates the cutting of material for a specific use, a stipulation of that fact will serve to identify the timber. For instance, the contract may require the operator to cut ". . . all pine trees which are suitable for the production of poles of size class 7-30 and larger, in conformity with the specifications of the American Standards Association for southern pine poles." One caution should be mentioned in this connection—the phrases "suitable for" and "suitable only for" may have totally different meanings, depending upon the range of uses to which the trees may possibly be put. Trees "suitable for pulp logs" will include those suitable for peelers, which are much more valuable. Trees "suitable for peelers" could not possibly include the lower log grades, such as woods logs. Trees "suitable only for pulp logs" cannot include the higher grades.

*By a combination of any of the foregoing means.*—This can best be explained by means of an example: ". . . all hemlock trees which measure 10 inches or larger at the stump, outside bark, not more than one foot above ground, and which are suitable only for pulpwood."

A common error in describing timber in cutting contracts consists of specifying only the volume that is to be cut. If the area on which the timber is located contains a total volume much greater than that specified in the contract, then the contract may be voidable for lack of certainty. Such descriptions are analogous to land descriptions which convey "40 acres in Section 16," but do not state which 40 acres. If contracts of this kind are partially performed, the buyer can take the best of the timber and leave the poorer material.

### Methods of Operation

The clauses which describe the methods of operation are the heart of a timber sale contract. They should define precisely what the seller wants and requires in the way of operating techniques that will protect his residual values and his business interests. Properly written, they also inform the contractor as to the operating problems he must meet, and give him complete data upon which to predicate his cost computations. It should be evident that definite requirements ordinarily result in a more satisfactory price arrangement than would be true of a contract which lacks specificity.

Contracts for the cutting of timber often specify that ". . . the operation will be conducted in a careful, prudent and workmanlike manner." This clause is usually interpreted legally as meaning only that the operation must be conducted with at least the degree of care, prudence and workmanship that is characteristic of the better operators in the locality, no matter how wasteful and careless such operators may be. Another such clause, of recent origin, requires that the operation be conducted ". . . according to good forestry practices." The nebulous character of such clauses render them meaningless, insofar as their interpretation is concerned.

Clauses of this kind are so ineffectual in themselves that an alternative sometimes is found by requiring that the work be done under the direction and supervision of the seller's forester or other representative, or to his satisfaction. Many attorneys feel that requirements of this nature tend to void the character of the contract and change the relationship of the contracting parties to one of employer and employee. In any case, they provide an open door to friction and dissatisfaction, and sometimes to litigation.

Sellers who specify that a considerable area be logged, without stating the order in which the logging will take place, run the risk of having the contractor cut only the best and most accessible timber, leaving the remainder. Since the operator can always claim his intention to log the rest of the timber, there is thus no breach of this contractual clause until the expiration date of the contract. To ensure better compliance, the contract should specify the order in which the various settings will be logged, and require that the operator not be allowed to move to the next setting until the logging on the existing setting has been completed in accordance with the terms of the contract. Under such an arrangement, the poorer and less accessible areas can be listed for cutting in the early stages of the operation, leaving the more lucrative portions for last. This method has an advantage over and above the incentive it provides—if the operator moves to the next setting without having met requirements on the last area logged his contract is breached the moment he moves. In the event of a breach, the remainder of the area will ordinarily afford an attractive operating proposition to a different operator.

Risk of damage to the residual stands, or to the soil, watershed, or other values can be minimized by specifying the kind and size of the logging equipment to be used and the way in which it is to be used. Fully as important is a statement of what methods and equipment will not be used.

### Conclusion

Since the precise wording of a contract is subject to varied interpretation in different states, the final phrasing should always be drawn up by competent legal counsel. The forester should be certain, however, that it is a true reflection of management objectives.

The fact that a given contract meets the needs of a certain situation does not necessarily mean that it is well adapted to a different set of circumstances, or to the needs of other parties. If a contractual matter is of sufficient importance to deserve embodiment in a written instrument, it logically follows that it deserves individual treatment. Contracts of the "canned" variety are usually inadequate and inappropriate.

# Effect of Heavy Selection Logging on the Herbaceous Vegetation in a Ponderosa Pine Forest in Northern Arizona[1]

**Joseph F. Arnold**

Range conservationist, Southwestern Forest and Range Experiment Station, Tucson, Ariz.

MULTIPLE USE MANAGEMENT raises the question of the specific effects logging has on the herbaceous forage cover of timbered areas.

The results here presented show how heavy selection logging affects the herbaceous vegetation of heavily timbered areas in northern Arizona. The study reports: (1) The extent of canopy reduction as a result of heavy selection logging, (2) the overall response of the herbaceous vegetation, and (3) the separate effects of canopy release, slash accumulation, and surface disturbances on the ground cover.

## Experimental Area

The Rock Top Logging Unit, located in the Coconino National Forest approximately 35 miles south of Flagstaff, was opened for logging in 1937. The logging unit embraced about 16,200 acres, of which 15,485 were forested. The principle of economic selection logging, in which the mature trees that give a financial return are marked for cutting (*4*), was employed in the operation. A 40-acre experimental block was located near the northwest boundary of Rock Top Logging Unit within a virgin timber stand at elevation of 7,200 feet. Of this 40-acre experimental block, 14 acres were selected at random for detailed examination.

Merchantable timber stands on the 14 experimental acres were considerably heavier than those of the Rock Top Logging Unit as a whole. This is indicated by the total volume column in Table 1.

The experimental block was logged early in 1942. Although the actual volume of merchantable timber (over 11.5 inches d.b.h.) harvested from the 14 sample acres was considerably greater than the average for the entire logging unit, the mean volume percentages were almost identical (Table 1).

Photo by U. S. Forest Service

FIG. 1.—Heavy slash accumulations smother out considerable amounts of the original grass and weed cover and thus cancel the beneficial effect of canopy release. Rock Top experimental area 5 years after heavy selection logging.

In comparison to lighter selection logging, which is currently being practiced in the Southwest, removal of 68 percent of the merchantable volume may appear to be a destructive drain on the timber resource. The 68 percent volume, however, was harvested from only a third of the merchantable trees. Logging reduced the average number of merchantable trees from 24 to 15 per acre. Removal of large and overmature ponderosa pine from 5 of the plots contributed measurably to volume harvested. In addition, heavy selection logging removed a considerable volume of timber from 6 other sample acres which were heavily infested with mistletoe.

Nonmerchantable trees on the sample plots averaged almost twice the number recorded per acre for the entire logging unit. Although cutting was confined to merchantable timber, a considerable number

[1]Acknowledgement is gratefully made to George E. Glendening, under whose supervision this study was planned and established in 1941.

TABLE 1.—VOLUME OF MERCHANTABLE TIMBER (OVER 11.5 INCHES D.B.H.)

| | Mean volume cut | | Mean volume left | | Total volume |
|---|---|---|---|---|---|
| | Board feet per acre | Percent | Board feet per acre | Percent | Board feet per acre |
| 14 sample acres[1] | 8,074 | 68.2 | 3,769 | 31.8 | 11,843 |
| 15,485 acre logging unit[2] | 5,879 | 68.6 | 2,691 | 31.4 | 8,570 |

[1]Surveyed by Homer German of the Coconino National Forest.

[2]Mason, David T. and Donald Bruce. Selective logging analysis of the Flagstaff operation of the Southwest Lumber Mills, Inc. Unpub. report in files Southwestern Forest and Range Experiment Station. 129 pp. 1938.

TABLE 2.—STAND TABLE OF NONMERCHANTABLE TREES BY DIAMETER CLASSES (NUMBER OF TREES PER ACRE BEFORE LOGGING IN 1941 AND FIVE YEARS AFTER LOGGING IN 1947)[1]

| | Diameter classes—d.b.h. | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Year | 0 | 1″ | 2″ | 3″ | 4″ | 5″ | 6″ | 7″ | 8″ | 9″ | 10″ | 11″ |
| 1941 | 1158 | 144 | 140 | 108 | 84 | 52 | 38 | 38 | 26 | 11 | 7 | 4 |
| 1947 | 756 | 84 | 83 | 73 | 68 | 53 | 48 | 36 | 28 | 16 | 10 | 5 |
| Difference | −420 | −60 | −57 | −35 | −16 | +1 | +10 | −2 | +2 | +5 | +3 | +1 |

[1]Initial counts of 1941 were repeated in 1947 on 224 0.03 acre sample plots.

TABLE 3.—EXTENT OF CANOPY RELEASE AS INDICATED BY CHANGES IN THE PERCENT OF GROUND COVERED BY PINE CANOPY BETWEEN 1941 (BEFORE LOGGING) AND 1947 (5 YEARS AFTER LOGGING)

| Year | Commercial timber (over 11.5″ d.b.h.) | Noncommercial timber (under 11.5″ d.b.h.) | Other woody species | openings (no canopy) |
|---|---|---|---|---|
| | *Percent* | *Percent* | *Percent* | *Percent* |
| 1941 | 18.8 | 34.7 | 3.5 | 43.0 |
| 1947 | 9.4 | 29.2 | 2.3 | 59.1 |
| Difference | −9.4 | −5.5 | −1.2 | +16.1 |

of seedling and sapling pines were destroyed by logging. Most severe losses were inflicted on trees under 5 inches d.b.h. (Table 2). Destruction of young trees constituted a part of the logging treatment insofar as the reduction in canopy favored a release in herbaceous growth.

Including merchantable and nonmerchantable stands, the experimental plots were more fully occupied by trees of all age classes than the Rock Top Logging Unit as a whole. Because tree dominance exerts a controlling influence over the herbaceous understory even where livestock are excluded (*1*), dense pine stands were largely responsible for an extremely sparse herbaceous ground cover.

Timbered slopes of the experimental area received light to moderate sheep use under the herding system. Although deer, elk, and a few cattle made some additional use of the timbered slopes, they generally concentrated more freely on a small park which bordered the experimental area on two sides.

The composition of the sparse herbaceous vegetation was marked by a prevalence of grass and grasslike species over perennial weeds and annuals. In general, species occurred in the following order of abundance: Muttongrass (*Poa fendleriana*), squirreltail (*Sitanion hystrix*), Arizona fescue (*Festuca arizonica*), mountain muhly (*Muhlenbergia montana*), sedges (*Carex* spp.), spike bentgrass (*Agrostis exarata*), deergrass (*Muhlenbergia rigens*), spike muhly (*M. wrightii*), and black dropseed (*Sporobolus interruptus*). The more common weeds included: Several species of daisies (*Erigeron* spp.), dandelion (*Taraxacum palustre*), yarrow (*Achillea lanulosa*), clover (*Trifolium fendleri*), pseudocymopterus (*Pseudocymopterus montanus*), several species of cinquefoil (*Potentilla* spp.), mountain dandelion (*Agoseris arizonica*), and vetch (*Vicia americana*). Annuals which occurred in small amounts before logging but increased after logging included: Knotweed (*Polygonum douglasi*), lambsquarters (*Chenopodium album*), amaranth (*Amaranthus* spp.), and sixweeks dropseed (*Sporobolus microspermus*).

Sixteen 50-foot line transects were located at random within each of the 14 sample acres, giving a total of 224 transects. Following the procedure described by Canfield (*2*), measurements include the intercept of: (1) Herbaceous species, (2) pine canopy by size classes, (3) pine needle litter, and (4) slash. Initial transect measurements were recorded in the fall of 1941 before logging. Although it was originally planned to remeasure the transects in 1942 immediately after logging, because of the war remeasurements were delayed until the fall of 1947.

### Extent of Canopy Release

The canopy of commercial-sized trees covered a little less than 19 percent of the surface area before logging (Table 3). Removal of 68 percent of the merchantable volume reduced this canopy intercept by one-half as shown by measurements 5 years following logging. The canopy of noncommercial timber and such other woody species as oaks, juniper, and sumac was also reduced and the aggregate area of large and small openings increased from 43 to 59 percent of the area. The growth of young trees between 1941 and 1947 increased the canopy of some transect samples. Opening up of the canopy was thus somewhat greater at the time of logging than the 16 percent recorded in 1947, 5 years after logging.

### Total Response of Herbaceous Vegetation

Heavy selection logging increased the total herbaceous plant density very little by 1947 (Table 4). Den-

sity of the total herbaceous vegetation increased less than one-tenth of one percent, a change which represents an increase of about 11 percent over the original plant cover. The initial herbaceous vegetation was extremely sparse before logging, being less than one percent as measured by the line intercept method. This low density was largely caused by the controlling dominance of the timber stands. Because tree dominance was maintained even after logging and because logging disturbances thinned out the ground cover, no sizable increase occurred in the initially sparse herbaceous vegetation.

Clipping studies of comparable timber sites with similar herbaceous vegetation indicate that the initial density represents an average yield of approximately 100 pounds of air-dry herbage per acre. Considerably greater herbage yields are undoubtedly produced on other parts of the Rock Top Logging Unit where the average timber stands are less dense. Though livestock depend more heavily on grassland parks and small forest openings, timber sites like the experimental area contribute to summer grazing in spite of low herbage yields. The small overall increase in herbaceous density on the experimental site, however, has little practical meaning in terms of forage production.

Though the loss of perennial grass density with an accompanying increase in perennial weeds and annuals between 1941 and 1947 may appear unimportant for the area as a whole, small localities within the experimental area are affected more significantly by specific logging influences.

TABLE 4.—CHANGES IN HERBACEOUS PLANT DENSITY BETWEEN 1941 (BEFORE LOGGING) AND 1947 (5 YEARS AFTER LOGGING) AS DETERMINED FOR 224 SAMPLES

| Year and Difference | Perennial grasses | Perennial weeds | Annual grasses and weeds | Total density |
|---|---|---|---|---|
| | *Percent* | *Percent* | *Percent* | *Percent* |
| 1941 | 0.45 | 0.15 | 0.03 | 0.63 |
| 1947 | 0.42 | 0.21 | 0.07 | 0.70 |
| Difference | −0.03 | +0.06 | +0.04 | +0.07 |

TABLE 5.—EFFECTS OF HEAVY SELECTION LOGGING ON HERBACEOUS DENSITY AS INDICATED BY A GROUP ANALYSIS OF THE 224 PAIRED TRANSECT SAMPLES

| Conditions affecting density | Year | Density—percent ground occupied: Perennials Grass | Perennials Weeds | Annuals | Total | No. of transects |
|---|---|---|---|---|---|---|
| **Samples intercepting logging roads & skid trails** | | | | | | |
| A (canopy decrease: 25.4% Slash, 8.7%) | | | | | | |
| | 1941 | 0.41 | 0.08 | 0.02 | 0.51 | 26 |
| | 1947 | 0.24 | 0.16 | 0.11 | 0.51 | |
| | Difference | −0.17 | +0.08 | +0.09 | +0.00 | |
| **Samples not intercepting logging roads & skid trails** | | | | | | |
| $B_1$ (canopy increase: 5.6%, Slash, 6.7%) | | | | | | |
| | 1941 | 0.49 | 0.26 | 0.08 | 0.83 | 56 |
| | 1947 | 0.37 | 0.26 | 0.08 | 0.71 | |
| | Difference | −0.12 | ±0.00 | +0.00 | −0.12 | |
| $B_2$ (canopy increase: 4.9%, No slash) | | | | | | |
| | 1941 | 0.37 | 0.18 | 0.04 | 0.59 | 16 |
| | 1947 | 0.34 | 0.27 | 0.01 | 0.62 | |
| | Difference | −0.03 | +0.09 | −0.03 | +0.03 | |
| $C_1$ (canopy decrease. 25.9%, Slash, 13.2%) | | | | | | |
| | 1941 | 0.45 | 0.11 | 0.02 | 0.58 | 108 |
| | 1947 | 0.48 | 0.19 | 0.08 | 0.75 | |
| | Difference | +0.03 | +0.08 | +0.06 | +0.17 | |
| $C_2$ (canopy decrease: 28.3%, No slash) | | | | | | |
| | 1941 | 0.41 | 0.08 | 0.00[1] | 0.49 | 18 |
| | 1947 | 0.53 | 0.12 | 0.01 | 0.66 | |
| | Difference | +0.12 | +0.04 | +0.01 | +0.17 | |

[1]Annuals present in trace amounts.

## Specific Effects of Heavy Logging

To evaluate specific effects of the heavy type of logging treatment, the 224 paired transects were grouped into 5 classifications (Table 5). Influences considered to affect adversely the original herbaceous cover included: (1) Surface disturbances caused by skidding and the construction of logging roads, (2) heavy accumulations of slash, and (3) growth of pine canopy between 1941 and 1947. Conditions which seemed particularly favorable to the growth of perennial grass included: (1) A reduction in tree stands as indicated by canopy decrease, and (2) the absence of both slash and surface disturbances. These influences functioned either together or in opposing combinations to effect changes in the herbaceous vegetation.

Twenty-six of the 224 transects intercepted logging roads and skid trails where the herbaceous vegetation was either completely or partially destroyed. (Table 5-A). Slash covered 8.7 percent of the transect lines. Because much of the herbaceous vegetation was either destroyed by surface disturbance or smothered out by heavy slash, the canopy decrease of 25.4 percent had no beneficial effect on the ground cover. The decrease in perennial grass density under these conditions represents a loss of approximately 40 percent of the original sparse grass cover. Unlike perennial grass, the density of perennial weeds doubled between 1941 and 1947, while the area occupied by annual weeds and annual grasses increased by five and one-half times. Density of the total herbaceous plant cover reflected no change between 1941 and 1947

since the decrease in perennial grass was balanced by the increase of perennial weeds and annuals.

The remaining 198 transects did not intercept logging roads or skid trails although many of them suffered some temporary soil disturbance at the time of the logging. Disturbance of small areas probably resulted in some loss of herbaceous density which was not recovered by 1947. Fifty-six of the 198 transect lines showed an average increase of 5.6 percent in the pine canopy and an average slash intercept of 6.7 percent (Table 5-$B_1$). The increase in canopy represents the growth of crown spread between 1941 and 1947 on transects which were largely undisturbed by logging except for the accumulation of slash from adjacent logged areas.

Heavy slash combined with the effect of canopy increase was detrimental to the establishment of perennial grasses. Even after a recovery period of 5 years, the decrease represents a loss of 25 percent of the original grass cover. Densities of perennial weeds and annuals showed no changes between 1941 and 1947.

Sixteen of the 198 transects were primarily influenced by an average canopy increase of 4.9 percent (Table 5-$B_2$). With an increase in canopy and an absence of slash, perennial grass and annuals showed minor density losses, while perennial weeds increased considerably over their original density in 1941. Since the increase in perennial weed density was greater than the combined losses of perennial grass and annuals, the total herbaceous density showed a slight increase.

A comparison of the $B_1$ and $B_2$ sections in Table 5 indicates that the effect of heavy slash accumulations accounted for a greater loss in the herbaceous vegetation than did the effect of canopy increase alone.

On 108 transects, the decrease in canopy between 1941 and 1947 averaged 25.9 percent while slash accumulations averaged 13.2 percent (Table 5-$C_1$). The benefit of canopy release was thus partially canceled by slash (Fig. 1). Under these conditions, perennial grass density showed a slight increase between 1941 and 1947. The density of perennial weeds increased approximately 70 percent while annuals increased fourfold over the 1941 measurements. The density of all herbaceous species increased almost 30 percent over the original cover.

An average canopy decrease of 28.3 percent with no slash occurred on 18 of the 198 transects not affected by logging roads and skid trails (Table 5-$C_2$). This group of samples illustrates the favorable growth of herbaceous vegetation in response to canopy release. The gain in grass density between 1941 and 1947 represents an increase of approximately 30 percent. The change in perennial weed density represents an increase of 50 percent over the original weed population. Although the annuals practically doubled, the change in their actual density between 1941 and 1947 was barely measurable. Total herbaceous density increased approximately 35 percent.

Even after 5 years, perennial grasses did not fully recover from surface disturbances. Once destroyed, native perennial grasses revegetate denuded surfaces slowly by natural means. Disturbances, on the other hand, favor the increase of annuals and perennial weeds. In the process of natural revegetation and secondary succession, annuals and perennial weeds are the first to reoccupy denuded areas. Denuded areas varied greatly in size between the 5 groups because small surface disturbances caused by logging operations other than the construction of roads and trails influenced many of the samples. For this reason, the density pattern of annuals and perennial weeds was extremely irregular between the 5 comparisons.

### Effect on Pine Litter

Pine needle litter was most severely disturbed by skidding and the construction of logging roads (Table 6). The 26 transects which crossed logging roads and skid trails showed a loss equivalent to about 40 percent of the original litter cover, even after a recovery period of 5 years. On the remaining 198 transects, pine needle litter was removed from small areas by such minor logging disturbances as occurred in felling and limbing operations. Part of these small denuded areas, persisting even after 5 years of possible recovery, accounted for the 2.9 percent loss in litter cover by 1947.

An average of only 5.5 percent of the ground surface for the experimental area as a whole was denuded of protective litter. Skidding and the construction of logging roads accounted for most of this average loss of litter. Many of the denuded areas remained bare because pine needles were washed away by erosion as they fell and were not allowed to accumulate during the 5 years following logging. Litter failed to accumulate on a few denuded areas which were located outside the normal dispersal range of falling needles from nearby pine stands. Under such conditions, a needle litter cover is restored very slowly to denuded areas. In several localities erosion damage was somewhat extended beyond the areas denuded of a protective litter cover where eroding soil from disturbed upper slopes was deposited on undisturbed areas of the lower slopes.

TABLE 6.—THE EFFECT OF HEAVY SELECTION LOGGING ON PINE NEEDLE LITTER

| | Transects crossed by loading roads and skid trails | Transects subject to minor disturbance | All transects |
|---|---|---|---|
| Number of transects | 26 | 198 | 224 |
| Percent of ground covered by litter: | | | |
| 1941 | 63.6 | 71.8 | 70.9 |
| 1947 | 38.6 | 68.9 | 65.4 |
| Loss | −25.0 | −2.9 | −5.5 |

Adding the 5.5 percent loss in litter to the 6.8 percent covered by heavy slash, we obtain a total logging damage of 12.3 percent of the experimental area as a whole 5 years after logging. By comparison, studies of the immediate effects of pine logging in eastern Washington and Oregon showed that horse logging damaged 16.6 percent, cable logging 29.9 percent, and tractor logging 26.0 percent of the areas studied (*3*). Cable logging caused the greatest amount of slash damage while tractor logging caused the most severe soil disturbance. In the Washington and Oregon studies, first year measurements following logging showed that perennial grasses suffered greater damage than weeds and shrubs. This was similarly apparent in Arizona even though the measurements were not repeated until 5 years after logging. Forage was reduced considerably more in the eastern Washington and Oregon study because of differences in plant growth, logging practices, and in the recovery intervals after logging.

## Importance of Results

The present system of logging on the national forests of the Southwest consists of lighter cutting at shorter intervals than that applied to the Rock Top Unit. Even so, the reduction of perennial bunchgrass density by heavy slash and the erosion hazard created by soil disturbance need to be kept in mind when management practices are designed to maintain multiple land-use values.

The areas denuded by the skidding and road construction operations practiced in the area studied calls attention to the need for measures to minimize soil erosion and restore a herbaceous cover. In practice, erosion may be reduced by adequately draining skid trails and roads with cross ditches and by plugging gullies with slash. Restoration of the herbaceous cover can be aided by reseeding adaptable and desirable quick-growing grasses and weeds. A light scattering of slash over reseeded abandoned logging roads and skid trails favors the establishment of both grass and pine seedlings by providing temporary protection from livestock. Restoring the herbaceous cover by reseeding also helps to minimize erosion.

The amount of surface disturbance caused by a single logging operation may not be serious, but the recovery rate is so extremely slow that denuded spots tend to persist over several decades. At best, natural revegetation may only partially cover denuded areas between frequent cutting cycles of 30-year intervals or less. Compared with the original bunchgrass vegetation, annuals, and unpalatable half-shrubs which frequently characterize partial recovery, provide much less desirable forage and inadequate soil protection. Because the rate of disturbance resulting from frequent logging may exceed the rate of natural recovery, application of corrective measures to minimize erosion and to restore a desirable herbaceous cover immediately after logging is thus clearly indicated.

## Summary

1. An investigation was conducted on a segment of the Rock Top Logging Unit located 35 miles south of Flagstaff, Ariz., to determine how heavy selection logging in densely timbered areas affected the herbaceous plant and litter cover.

2. A comparison of 224 fifty-foot line transects before and 5 years after logging showed that canopy release from heavy selection logging increased the combined area of large and small openings from 43 to 59 percent. In the overall effect of this logging, however, canopy release was more than canceled by surface disturbances and by the loss in density of the better perennial bunchgrasses from heavy slash.

3. Group comparisons of the 224 random transects showed the following pattern of changes in perennial bunchgrass density between 1941 and 1947: (1) The greatest loss on logging roads and skid trails, (2) an intermediate loss under the combined effects of canopy increase and heavy slash, (3) the least loss under an increase in canopy in the absence of slash, (4) the least gain where canopy release was partially canceled by heavy slash, and (5) the greatest gain under canopy release without slash. Annuals and perennial weeds showed an irregular response to the effects of the logging, but were generally favored by surface disturbances.

4. Destruction of the protective pine needle litter cover was mainly concentrated on local areas. Soil transported from logging roads and skid trails of the upper slopes was frequently deposited on undisturbed areas of the lower slopes.

5. The results of the study constitute additional evidence against heavy selection logging and support the system of light cuttings now in use in the national forests of the Southwest. Results also show the need for holding denuded areas caused by logging operations to a minimum. Where areas such as skid trails and roads are unavoidably disturbed, erosion can be minimized by adequately draining them with cross ditches. Restoration of the herbaceous cover by scattering slash and by reseeding adapted species also help minimize erosion.

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# A Half Century of Reforestation in the Tennessee Valley[1]

**John C. Allen**

Tennessee Valley Authority, Norris.

*Over a million and a half acres of land in the Tennessee Valley needed reclaiming in 1933. Much of it was open land in various stages of erosion, but the estimate also included thousands of acres of understocked woodland. Since then, more than 246 million forest tree seedlings have been planted. Reported here is the performance of black locust, yellow-poplar, and shortleaf, loblolly, Virginia, and white pines. These six species represent 94 percent of 170 million trees planted through 1946. Also reported are the reforestation accomplishments of all agencies since 1890.*

TREE PLANTING to reclaim old fields in the Tennessee Valley was first undertaken on a large scale in 1890 on the Biltmore Estate near Asheville, N. C. (*13*). Reforestation on this estate continued through 1912 under the supervision of Gifford Pinchot, C. A. Schenk, and C. D. Beadle. Many of the attempts to plant the same hardwood species found native in woodlands near the planting areas proved unsuccessful. Plantings of pines and some of the other conifers, however, were generally successful on these sites. Reports on these plantings conclude that the changes in site conditions brought about by agricultural use and abandonment made necessary the initial planting of the more pioneering species.

Black locust was planted for erosion control in western Tennessee as early as 1915 (*15*). When planted in gullies behind brush dams, this species developed into fence post material at an early age. In later years, after increased interest in black locust had extended its use to sites that would not support it, the conifers received more attention for planting on depleted lands. This coincided with a nation-wide trend in species use for erosion control plantings prior to 1941 (*19*). Other types of plantings in the valley included those for tree crops (*7*), margins of flood control reservoirs (*21*) and special quality products (*5*). These differed from normal erosion control plantings in that nut production, tolerance to fluctuating water levels, and pulpwood production were the primary objectives.

The 26 million-acre Tennessee Valley includes parts of seven states—Alabama, Georgia, Kentucky, Mississippi, North Carolina, Tennessee, and Virginia. Elevations range from 6 500 feet in the Appalachian Mountains to 300 feet at the river's mouth (*27*). Topography is varied. There are the steep ridges and narrow valleys of the mountain area, the high tableland of the Cumberland Plateau, the undulating Nashville Basin with its surrounding rough, broken Highland Rim, and the rolling land of northern Alabama and western Tennessee.

The valley also contains a variety of soils. Those in the Appalachian Mountain region are derived from granite, gneiss, and schist parent material. Limestone soils, both the pure and the cherty, dolomitic forms, predominate in the Great Valley. The limestones in the Nashville Basin region are relatively free from cherty impurities; the dolomitic form is most prevalent on the Highland Rim. Sandstone soils are characteristic of the Cumberland Plateau. The Gulf Coastal Plain soils in the western part of the valley are formed from marine sediments of sands and clays.

Normally, precipitation in the valley is 51 inches, well distributed throughout the year. However, precipitation during the fall months is slightly less than at other seasons. Mean temperature for the warmest month is 80 degrees, for the coldest month 40 degrees. The Appalachian Mountain areas receive more rainfall and have somewhat lower temperatures than these valley averages.

Forests cover 54 percent of the valley's total land area (*23*). Forest cover is heaviest in the eastern part. In Alabama and the western valley area, the forests are typically farm woodlands. The yellow pine-hardwood and the upland hardwood types predominate throughout. The cedar-hardwood type occurs on a smaller area in the central part of the valley.

## Review of Literature

Studies of the influence of various site factors on forest establishment and growth have been reported over the years. Response to differences in soil depth, character of profile, texture, moisture relationships, and origin have indicated variation between species. Black locust and yellow-poplar grow best on the deeper soils with loose, non-plastic subsoils (*4, 20*). They grow better on pure limestone soils than on other soils (*12, 14*). Reports indicate that the well drained, drier sites promote the best development of most conifers (*1, 17, 18, 22*), although white pine is favored by the cooler, more moist sites in eastern Tennessee (*16*). Loblolly pine also shows a higher site index on the deeper soils with poor surface drainage in the eastern coastal plain area (*11*). Site index of loblolly and shortleaf pines on certain soils in North Carolina is influenced most by depth of the A horizon and the imbibitional water value of the B horizon (*8*). Condition of erosion directly influences tree growth. On certain soils in South Carolina, site index of loblolly pine dropped 10 feet for each greater degree of erosion (*9*).

Aspect and stage of vegetative ground cover also influence tree

[1]This study was conducted by the late George S. Perry, T. H. Silker, formerly of TVA, and personnel of the Forestry Investigations Branch, Forest Management Section, W. H. Cummings, chief.

TABLE 1.—TOTAL PLANTING OF MAJOR TREE SPECIES BY PERIOD, BY AGENCY, AND BY STATE IN THE TENNESSEE VALLEY THROUGH 1946

| Seedling distribution | Shortleaf pine | Loblolly pine | Virginia pine | White pine | Yellow-poplar | Black locust | Other Conifers | Other Hardwoods | Total |
|---|---|---|---|---|---|---|---|---|---|
| | *Thousands of trees* | | | | | | | | |
| By period | | | | | | | | | |
| 1890-1923 | 35 | ... | ... | 536 | 8 | 22 | 113 | 229 | 943 |
| 1924-1933 | 210 | 154 | ... | 190 | 61 | 844 | 513 | 36 | 2,008 |
| 1934-1938 | 16,162 | 7,372 | 4,477 | 803 | 375 | 31,606 | 1,658 | 1,120 | 63,573 |
| 1939-1946 | 32,336 | 26,740 | 901 | 3,831 | 2,061 | 32,447 | 2,483 | 3,347 | 104,146 |
| By agency | | | | | | | | | |
| States | 1,312 | 2,524 | ... | 693 | 183 | 5,281 | 456 | 161 | 10,610 |
| USFS | 1,021 | 221 | ... | 1,756 | 141 | 80 | 922 | 11 | 4,152 |
| Private | 35 | ... | ... | 553 | 26 | 22 | 395 | 229 | 1,260 |
| TVA | 46,375 | 31,521 | 5,378 | 2,358 | 2,155 | 59,536 | 2,994 | 4,331 | 154,648 |
| By state | | | | | | | | | |
| Alabama | 7,488 | 14,001 | 43 | 1 | 341 | 4,870 | 798 | 1,004 | 28,546 |
| Georgia | 2,427 | 1,825 | 3 | 12 | 7 | 781 | 39 | 20 | 5,114 |
| Kentucky | 97 | 969 | 1 | 5 | 15 | 551 | 200 | 183 | 2,021 |
| Mississippi | 72 | 977 | ... | ... | ... | 247 | 56 | 5 | 1,357 |
| North Carolina | 5,204 | 102 | 484 | 3,802 | 451 | 6,084 | 1,297 | 339 | 17,763 |
| East Tennessee | 26,773 | 6,691 | 4,630 | 1,205 | 1,265 | 22,296 | 1,742 | 1,535 | 66,137 |
| West Tennessee | 6,059 | 9,693 | 68 | 28 | 303 | 21,863 | 594 | 1,565 | 40,173 |
| Virginia | 623 | 8 | 149 | 307 | 123 | 8,227 | 41 | 81 | 9,559 |
| Total | 48,743 | 34,266 | 5,378 | 5,360 | 2,505 | 64,919 | 4,767 | 4,732 | 170,670 |

development. On some sites in eastern Tennessee shortleaf and white pines could not stand competition with dense vegetation (*16*). Their growth, as well as the growth of yellow-poplar and other hardwoods, was also influenced by aspect. Studies of the ecological succession of ground cover indicate that there is an increase in site quality with each higher stage of vegetal succession (*24*, *25*).

## Study Procedure

The extent of reforestation in the Tennessee Valley was determined from the records of the federal, state, and private agencies responsible for the reforestation program. Summaries of all plantings were compiled by species, county, and year through the 1946 spring planting season. That year was selected because it represented the end of a period of war activities which necessitated decreased emphasis on reforestation. Since 1946 nursery production and tree planting have increased at a rapid rate. The planting summaries are complete through 1946.

The plantation sampling survey began in 1939, continued in conjunction with other work, and was completed in 1948. Plantations for field examination were selected objectively from the records in TVA files of plantings made by the Civilian Conservation Corps and private landowners. The species planted, the year of planting, spacing, and the condition of erosion were thus obtained for each chosen plantation. For each plantation sampled, specific data were taken on four major site factors: erosion, soil origin, cover, and aspect.

The degree of erosion of topsoil and subsoil is classified into gully bottom, gully ridge and slope, and severe sheet, moderate sheet, and little or no erosion. The soils are classed by derivation from limestone, shale, Gulf Coastal Plain sands, and granite—acid crystalline rocks including gneiss and schist. Cover types are grouped by the state of living vegetal cover development: more than 50 percent of the area bare, in the first weed stage, or in the broomsedge-mixed woody stage. Aspect classes differentiate the cool, moist, protected slopes to the north and east from the hot, dry, more exposed slopes to the south and west.

Additional information included land treatment with reference to burning and grazing, preplanting site preparations, and any such treatment as mulching.

From 10 to 25 trees were measured in at least four rows to average out differences in sampling. Heights were taken to the nearest tenth-foot on trees up to 10 feet tall. Greater heights were measured to the nearest foot on dominant or codominant trees. Suppressed or overtopped trees were not measured; they were included in an estimate of survival stated in percent of the number originally planted.

Each sample represented uniform site conditions. Frequently, several samples representing different conditions were taken in a single plantation. No samples were taken from plantings that had failed completely, because in most cases it was too difficult to determine the cause of failure.

The data were summarized by the different site categories and by geographic origin. Sampling was sufficient for comparisons only between the eastern and western portions of the valley. The boundary between Alabama and Georgia and a generally northern extension of that boundary line divide the two areas.

Average growth differences between the eastern and western portions were not significant. Therefore, the data were combined, and summaries made of the average height growth of each of six species of trees by the four soil origins, five degrees of erosion, two aspects, and three vegetal covers. The occurrence of sample plantations in these classes was variable.

Accordingly, for each species standards were established for average annual height growth and standard deviation, or the unexplained variation of plantation samples within site groupings. Comparisons were made by the *t* test to determine significance of difference for each site grouping.

### Results

By the end of the 1946 planting season, 170 million trees had been planted in the Tennessee Valley. Total plantings of major species are given in Table 1 by period, by agency, and by state. The planting progress is indicated by the distribution in the four periods. When stated on an average annual rate of distribution for comparison there were 28 thousand trees of all species in the first period starting in 1890, 200 thousand in the second period 1924-1933, 13 million in the third 1934-1938, and 13 million in the fourth ending in 1946. Four agencies were primarily responsible for their distribution. State forestry departments produced nearly 11 million trees, U. S. Forest Service 4 million, private organizations 1 million, and TVA nearly 155 million. Trees from the Forest Service were virtually all planted on national forest land, chiefly in the eastern portion of the valley. A minor portion of the trees from the state agencies and TVA were planted on state forests or TVA reservoir land. The bulk of planting has been done on a greater variety of sites on private land.

During the initial period, the Biltmore Estate was the principal planting agency. During the second period, a pulp company produced and planted a substantial number of trees and the nurseries of the state agencies got under way. Creation of the TVA and its nurseries in 1933 boosted the valley production to significant numbers after that date. Planting was curtailed considerably during the war years of the 1939-1946 period. Then came another upswing which started the present accelerated planting program. All these 170 million trees were planted in the seven states about in proportion to the area of the state in the valley. The extensive distribution in Tennessee is given in Table 1 for east and west portions corresponding to geographic division of the Tennessee Valley.

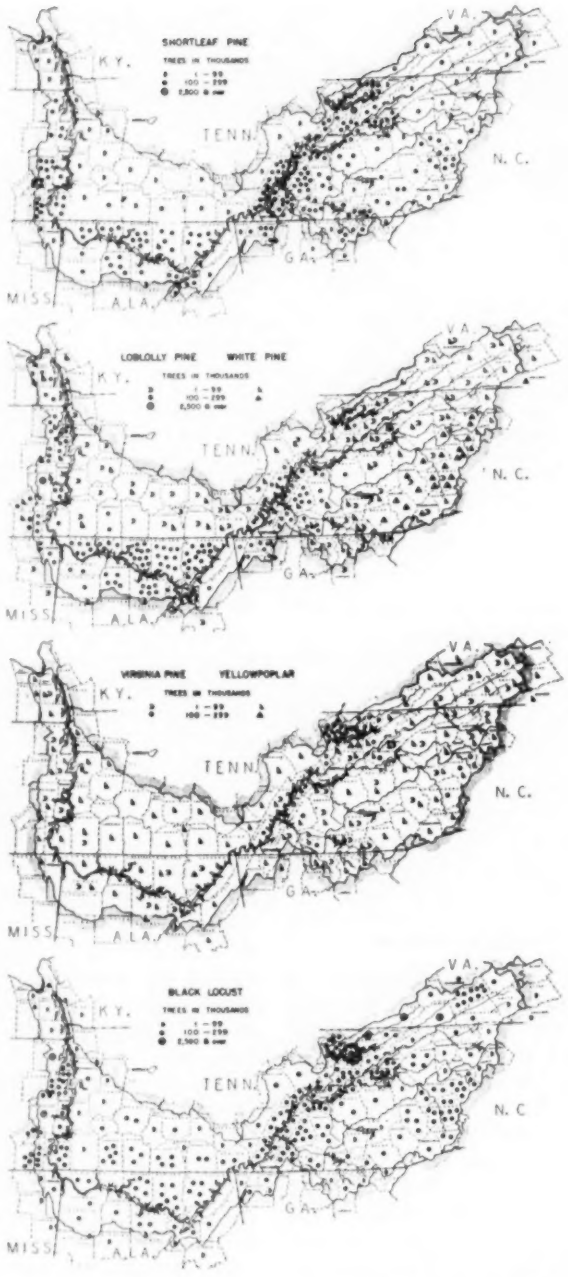


FIG. 1.—Distribution of plantings of six major species in the Tennessee Valley through 1946.

Of the six major species planted in the valley through 1946, black locust headed the list in over-all distribution (Table 1 and FIG. 1). It was planted extensively for erosion control in the earlier periods. Shortleaf and white pines were mainly confined to areas within their natural distribution ranges. Loblolly pine was planted somewhat north of its natural range. Yellow-poplar was distributed quite uniformly over the valley. Most of the Virginia pine, produced only in TVA nurseries, was planted in the eastern portion.

TABLE 2.—AVERAGE ANNUAL HEIGHT GROWTH (IN FEET) OF YOUNG PLANTATIONS IN THE TENNESSEE VALLEY ON DIFFERENT SITES

| Sites grouped by— | Shortleaf pine | Loblolly pine | Virginia pine | White pine | Yellow-poplar | Black locust |
|---|---|---|---|---|---|---|
| Erosion | | | | | | |
| Gully bottom | 1.4* | 1.8 | 1.7 | 1.6 | 1.4 | 2.1* |
| Gully slope | .8— | 1.5 | 1.4 | 1.6 | .6— | 1.4— |
| Severe sheets | 1.0— | 1.4— | 1.3 | 1.3— | .6— | 1.1— |
| Moderate sheet | 1.3* | 1.6 | 1.4 | | 1.2 | 1.9 |
| Little or none | 1.5* | 2.0* | 1.7 | 1.7* | 1.5 | 2.6* |
| Soil | | | | | | |
| Limestone | 1.1 | 1.6 | 1.3 | .9— | 1.1 | 2.0 |
| Shale | 1.0— | 1.3— | 1.4 | 1.4 | 1.7* | 1.5— |
| Granitic | 1.7* | 2.6* | 1.7* | 1.7* | 1.3 | 2.0 |
| Gulf Coastal Plain | 1.0— | 1.5— | 1.0 | | .8 | 1.5— |
| Cover | | | | | | |
| Bare | .8— | 1.5 | 1.4 | 1.3 | 1.3 | 1.0— |
| Weeds | 1.1 | 1.7 | 1.6 | 1.4 | 1.4 | 2.0 |
| Broomsedge | 1.2 | 1.6 | 1.4 | 1.5 | 1.1 | 1.7 |
| Aspect | | | | | | |
| North | 1.2 | 1.6 | 1.5 | 1.4 | 1.2 | 2.0 |
| South | 1.2 | 1.7 | 1.4 | 1.5 | 1.1 | 1.7 |
| All | | | | | | |
| Average height growth (feet) | 1.2 | 1.6 | 1.4 | 1.4 | 1.2 | 1.8 |
| Standard deviation (feet) | 0.35 | 0.40 | 0.50 | 0.30 | 0.79 | 1.04 |
| Average age (years) | 5 | 6 | 7 | 8 | 7 | 5 |
| Average survival (percent) | 81 | 88 | 87 | 89 | 88 | 83 |
| Plots basis (number) | 472 | 223 | 106 | 78 | 96 | 411 |

*Growth is better (5 percent significance) than the average for the species.
—Growth is poorer (5 percent significance) than the average for the species.

Many of the other conifers and hardwoods from TVA nurseries were planted for special purposes along reservoir margins.

Not reported in Table 1 are nearly 2 million seeds of black walnut and oak species which were distributed by TVA for spot-seeding. Much of this work was experimental and most of the planting failed. Damage by rodents to seed and seedling growth was a major factor in poor establishment of this type of planting.

From 1947 to date, a 6-year period, more than 76 million trees from TVA nurseries have been planted. These include 44 million loblolly pine and only 4 million black locust. Shortleaf and white pines accounted for 11 million each and yellow-poplar 3 million. Only 150 thousand Virginia pine were planted. The distribution in this current period emphasizes the trend toward the better timber species as the years progress. More loblolly and white pines and yellow-poplar are being planted, while Virginia pine and black locust are now reserved for more selected sites.

The performance of the six major species in the Tennessee Valley based on 1,386 samples in young plantations is summarized in Table 2. The basic data for each species on all sites at the bottom of the table deserve attention. The height growth averages for plantations 5 to 8 years in age should be minimum objectives for plantings under valley conditions. However, on the severely eroded or other difficult sites average growth may not be attainable.

On the basis of erosion conditions, the best growth for all species was found in gully bottoms and where erosion was the slightest. Poorest growth occurred on gully slopes and severely sheet eroded areas.

The granitic soils of the eastern mountain region produced the best growth of all species except yellow-poplar. It grew the best on shale soils. Growth of all species on the Gulf Coastal Plain soils in the west was relatively poor.

Growth on bare sites was generally poorer than on sites with a ground cover. Growth on north and south slopes showed no general differences nor significance for any species.

Of the four pine species, shortleaf is the most sensitive to the differences in the site conditions studied. On soils in the mountain region its growth equaled that of Virginia and white pines. Its general growth on shale and Gulf Coastal Plain soils has been below average. On sites with little or no erosion, or in gully bottoms, its growth has been better than average. A vegetative cover on the planting site is necessary to bring growth of this species up to the valley average. Broomsedge cover has given somewhat better growth than the earlier successional stage of weed species.

The poorer growth of loblolly pine on severely eroded sites indicates that it too is sensitive to severe exposures. However, actual growth of loblolly has been greater under all conditions of erosion than any of the other pines. It has also made better growth than the other pines on all soils except shale. The eastern mountain soils have produced outstanding growth of loblolly pine even though most of this type soil lies considerably outside the natural range for this species. Growth on the western Gulf Coastal Plain soils has been below the valley average but still surpasses that of other pines on these soils. Here again, many of the plantations sampled lie considerably north of the natural range for loblolly pine.

Growth of Virginia pine showed smaller differences in site conditions in this study than the other species. The better growth on granitic mountain soils was the only significance found for soils, erosion, cover, or aspect.

The best growth of white pine on the mountain soils and the better sites confirms expectations. However, its poor growth as sampled on limestone soils is subject to question. It is believed that further sampling in the eastern valley where the limestone soils are extensive would show a greater growth. The effects of moderate and severe sheet erosion are combined in Table 2 because of an inadequate number of samples in each class to portray the true expectancy of these conditions. From the samples obtained, white pine shows poorer than average growth under these conditions.

Yellow-poplar makes the best

growth on the shale soils. Its sensitivity to erosion is also generally recognized. Best growth is limited to the deeper soils where the soil moisture relationship is more favorable. Gully bottoms and the natural drainage areas usually provide these conditions.

The response of black locust to the various site conditions follows closely the results previously reported. Soil depth, moisture, and drainage seem to be the limiting factors in black locust development. The results of this study (Table 2) show the effects of these factors. The most severe conditions of erosion in all soils have given the poorest growth results. The underlying impervious layer is undoubtedly the limiting factor in the Gulf Coastal Plain soils in the western valley area. On such soils the best black locust growth was found in the gully bottoms where the trees can benefit from accumulations of moisture and wash deposits. On deep, undisturbed soils adjacent to the smaller drainages growth was satisfactory. While not statistically significant black locust made better growth on north slopes than on south slopes. This difference is more pronounced in the eastern portion of the valley where slopes are steeper—which accentuate contrasts in site due to aspect. On sites without ground cover, the poor growth of black locust is significant.

The effects of burning and grazing on species development are not presented because of erratic results. Survival was not subjected to analysis because of the irregularities found in spacing and the small size of the sample areas. Average estimates given in Table 2 show that survival is good for all six species.

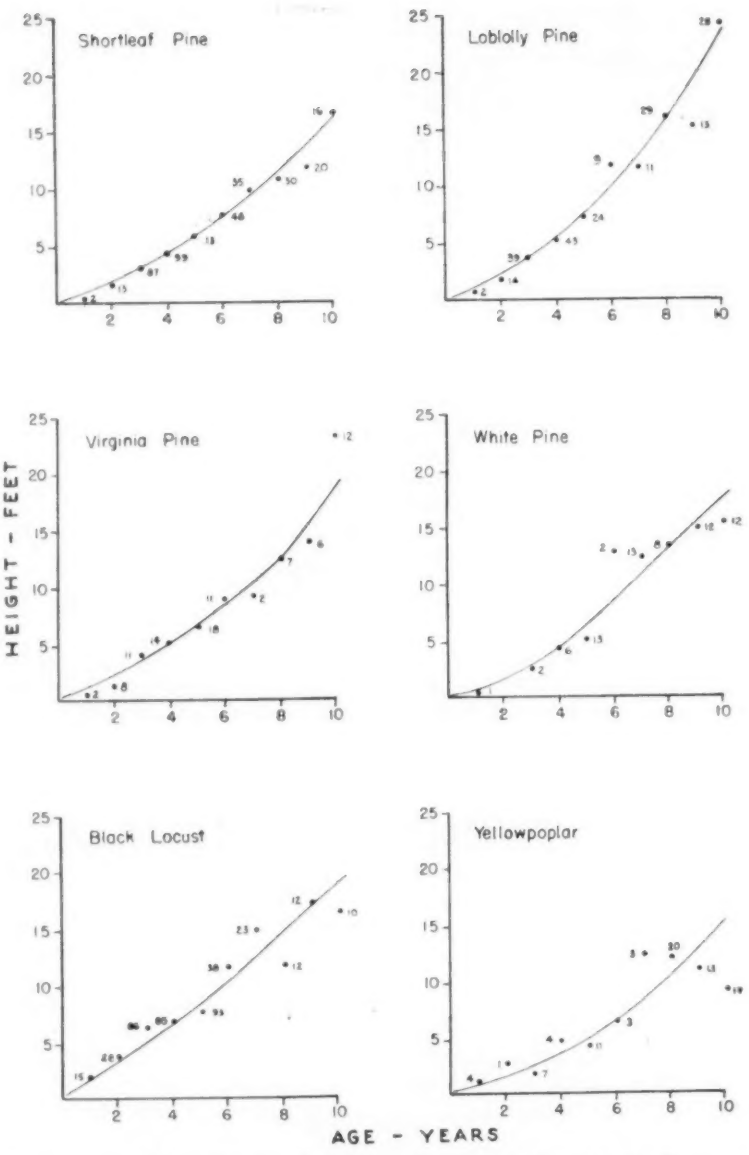


FIG. 2.—Curves of average growth of six major species planted in the Tennessee Valley.

## Discussion

Reforestation in the valley started extensively in the 1920's and gained impetus with the establishment of the Civilian Conservation Corps program. It reached a pre-war peak in 1941. During the war years, shortages of manpower caused a decline in tree planting activities. Since the war, reforestation has expanded rapidly. New nurseries have been established; planting machines have been tested and put into extensive use; promotional efforts, both public and private, are being strengthened and are bringing good results (*3*). The number of valley landowners participating in the planting program increased from 1,000 in 1946 to an average of 5,000 during the past three years. The peak year was 1950 when 6,000 landowners planted trees. With continued general success of plantings, the accelerated planting program should meet the objective of reforestation in the valley.

Of the 170 million trees planted in the valley through 1946, 65 million were black locust. This species had been used extensively since the planting program began. However, the expanded plantings of later years contained more and more of the other species. Black locust is now limited to sites most suitable

for its satisfactory development. The better quality timber species —shortleaf pine, loblolly pine, white pine, and yellow-poplar— have increased in numbers. It is interesting to note that TVA was the only agency in the region that advocated the planting of Virginia pine. It was planted mostly in the eastern portion of the valley during the early days of TVA. In later years it was limited to the more exposed sites; the better quality pines replaced it on the better sites.

The site-exacting character of shortleaf pine in the Tennessee Valley is substantiated by results of several test plantings. Its poorer growth on bare and severely eroded sites is conspicuous in extremely exposed areas such as the Copper Basin (*2*). In planting tests in the upper Appalachian Valley the growth of shortleaf pine after 11 years on north-facing limestone soils far surpassed that on shale soils. Growth on limestone south slopes was intermediate. The results of these tests and of the valley-wide study reported here show that shortleaf pine will make satisfactory growth on properly selected sites.

The planting of loblolly pine has been gradually extended north of its natural range in the Tennessee Valley. Development of these plantings to date has been gratifying. Their early height growth shows major differences in response to the site conditions studied, but only minor variation between plantings on similar sites. Performance of loblolly pine has generally surpassed other pines in comparable plantings in the valley. This is evident in height growth under varied conditions (Table 2), height of plantings on adverse sites in the Copper Basin of eastern Tennessee (*2*), and in quantity of litter deposited on the Gulf Coastal Plain soils in western Tennessee (*6*). The importance of geographic seed source has been brought out (*26*). Nearly all the valley lies within 100 miles of possible seed sources. The Kentucky portion, in the west, is at the extreme limit of that zone, and caution should be exercised in the selection of seed sources for planting in this portion. It is also recommended that loblolly pine planting be restricted to elevations less than 1,500 feet in the Appalachian Mountains.

It is evident from Table 2 that Virginia pine showed smaller difference between site conditions than the other species. However, it is disturbing that the variation between plantings is much greater than that from tree-to-tree in the same planting. The considerable amount of unexplained variation suggests causal factors not studied here — such as genetic or special environmental conditions.

The adaptability of Virginia pine to adverse planting sites is attested by its satisfactory growth and survival in the Copper Basin (*2*). Although the persistent branching habit reduces the quality of sawtimber, Virginia pine is valued for pulpwood production. This species deserves consideration for erosion control on difficult sites and for pulpwood production throughout the Valley.

The early height growth of white pine shows major differences in response to the site conditions studied. The tree-to-tree variation in growth closely approximates the variation from planting to planting. This indicates that for white pine the site classifications used in Table 2 have completely explained the variation in growth of plantings. In the 11-year old test plantings in the upper Appalachian Valley, white pine averaged nearly 2 feet in annual growth on limestone soils. Growth there was more favorable on north slopes. It is recommended that plantings of white pine be confined to the eastern portion of the valley where it is native and has proved adapted for planting.

The better growth of yellow-poplar on shale soils is also substantiated by results of the tests in the upper Appalachian Valley, where averages of 2 feet on north slopes and 1.4 feet on south slopes were attained annually. In this test the differences due to aspect seem to be important, but they tend to level out with lower slope gradients. The less eroded and deeper soils are necessary for best development of yellow-poplar.

Growth of black locust also shows major variations in response to site conditions. Like white pine, the differences in growth between trees within any plantation are as great as the differences between plantings. It is again evident that for black locust the site conditions studied completely explain the differences in growth shown in Table 2. Nutrient supplements from phosphate fertilizers have been beneficial to black locust (*10*). Moderately eroded sites should produce satisfactory growth of black locust if phosphate is applied at the time of planting. Early rapid growth is an aid in combating attacks of the locust borer. Reports of many studies of black locust performance are consistent in their conclusions that this species needs the deep moist and well-drained soils for best development.

The height curves (FIG. 2) include the growth data of those plantings found on adverse as well as favorable sites. Therefore, the curves seem somewhat lower than would be expected of growth on the best adaptation of species to site. With proper selection of planting sites, the growth should considerably exceed the averages plotted. Still, these curves should have utility in the range under 10 years not commonly defined in site index curves.

The results of this study indicate that the degree of erosion is the major controlling factor on any given soil site in the development of the six species in the valley. The species listed in Table 3 are considered best for planting under the general conditions of erosion and soil. This evaluation is based on the results given in Table 2, the interaction of the effects of erosion and soil, and observations of older plantations in the region. The capitalized names are those of the preferred species for planting under the given conditions. Beyond

TABLE 3.—SPECIES RECOMMENDED FOR PLANTING IN THE TENNESSEE VALLEY UNDER DIFFERENT EROSION CONDITIONS AND TYPES OF PARENT SOIL MATERIAL

| Erosion class | Parent soil material | | | |
|---|---|---|---|---|
| | Limestone | Shale | Granitic | Gulf Coastal Plain |
| Gully bottom | BLACK LOCUST[1]<br>LOBLOLLY PINE<br>Shortleaf pine | YELLOW-POPLAR<br>White pine<br>Shortleaf pine | BLACK LOCUST<br>WHITE PINE<br>Yellow-poplar<br>Shortleaf pine | BLACK LOCUST<br>Loblolly pine |
| Gully slope | LOBLOLLY PINE<br>VIRGINIA PINE<br>Shortleaf pine | VIRGINIA PINE | VIRGINIA PINE<br>White pine<br>Shortleaf pine | LOBLOLLY PINE |
| Severe sheet | VIRGINIA PINE<br>Loblolly pine<br>Shortleaf pine | VIRGINIA PINE<br>Shortleaf pine | WHITE PINE<br>VIRGINIA PINE<br>Shortleaf pine | LOBLOLLY PINE |
| Moderate sheet | LOBLOLLY PINE<br>SHORTLEAF PINE<br>Black locust | YELLOW-POPLAR<br>White pine<br>Shortleaf pine | WHITE PINE<br>BLACK LOCUST<br>Shortleaf pine | LOBLOLLY PINE<br>Shortleaf pine |
| Little or none | LOBLOLLY PINE<br>SHORTLEAF PINE<br>Black locust<br>Yellow-poplar | YELLOW-POPLAR<br>WHITE PINE<br>Shortleaf pine | WHITE PINE<br>BLACK LOCUST<br>Yellow-poplar<br>Shortleaf pine | LOBLOLLY PINE<br>Shortleaf pine<br>Yellow-poplar |

[1]Capitalized names are those of preferred species.

the broad classifications tabulated, local variations such as soil depth and moisture should be considered in the final selection of species for planting. Thus, yellow-poplar and black locust require the deeper, more moist soils found on northerly or protected sites. Further, black locust should be fertilized with phosphate at time of planting. For sites of increasing dryness or exposure, white pine, shortleaf pine, loblolly pine, and Virginia pine should be used in that order. White pine is limited to sites within its natural distribution range. Loblolly pine should be limited to lower elevations, which is the reason it is not listed under granitic mountain soils in Table 3. It should be recognized that the species coverage in Table 3 is not complete. Therefore, for certain sites, other species in addition to the six reported on here may give satisfactory results.

A substantial number of trees of other species have been planted in the Tennessee Valley. Many of these plantings were made for experimental purposes; others were on a trial basis for erosion control on the upland sites. Slash and pitch pines, white ash, black walnut, red gum, and oak species are among those planted. Results are variable and are not reported here. Many plantings failed completely. More data are needed for proper appraisal of the development of these species.

Mixtures of species have received some attention in experimental plantings. In the Great Valley, plantings in small group mixtures of yellow-poplar and white pine have proved successful (*16*). This type of planting deserves more consideration in the eastern part of the Tennessee Valley on sites where erosion is not too severe. Mixtures of black locust and yellow-poplar have also been successful on the deeper limestone soils. On the other hand, mixtures of black locust have shown adverse effects on the growth of shortleaf pine. White ash was stimulated very little by black locust in a white ash-black locust mixture. As has often been pointed out, a mixed planting may be more likely to escape destruction by insects and diseases. A mature mixed stand should yield a variety of products and thus be more valuable than a one-product stand. It should be obvious from the examples given that extreme caution should be used in the choice of species for group mixtures. Alternate tree mixtures are not recommended since usually one species dominates that type of planting and the other is crowded out. Only those species whose individual performances can stimulate each other will give the desired effects.

The job of reinforcing understocked woodlands with desirable species is receiving increased attention in the Tennessee Valley. Loblolly pine, white pine, shortleaf pine, and yellow-poplar all appear worthy of this type of planting. If the average survival and growth experienced in old field planting can be approached in interplantings, early improvement of depleted timber stands can be expected.

## Summary

Reforestation in the Tennessee Valley had its beginning on the Biltmore Estate, in North Carolina, about 1890. Through 1912 a considerable acreage was planted by early-day foresters. Many of the attempts to establish native hardwoods on abandoned agricultural land failed. Greater success was experienced with pines on these sites.

From 1890 through 1946, 170 million trees were planted for reforestation, mostly on abandoned agricultural lands on upland soils. Control of erosion was the primary consideration. Black locust and shortleaf and loblolly pines were the species most commonly planted. During the 6 years since 1946 TVA has made additional distribution of 76 million trees for planting in the valley.

More than 1,300 samples were taken from plantations of shortleaf pine, loblolly pine, white pine, Virginia pine, black locust, and yellow-poplar under a variety of site conditions. Degree of erosion, soil origin, ground cover, and aspect were the major factors used to classify site. The average annual height growth of each species was analyzed to determine the effect of site on development.

Extent of erosion and parent soil material influence most the growth of these six species. Best growth was found in gully bottoms and on non-eroded sites. Poorest growth occurred on gully slopes and on areas having severe sheet erosion. Granitic soils including

those of gneiss and schist origin, produced the best growth for all species except yellow-poplar. Growth of all species was below average on the Gulf Coastal Plain soils. All species, except white pine, showed average growth on the limestone soils.

Only shortleaf pine and black locust were significantly influenced by ground cover conditions. These two species showed poorer growth on sites having no cover. Shortleaf pine was only slightly benefited by a cover of broomsedge and woody plants. Black locust growth was best where a weed cover was present. No significant differences were found in the growth of the six species on different aspects. However, black locust growth was a little better on north slopes.

Shortleaf pine is very sensitive to differences in site. Growth is poorest on the most severely eroded exposures. Loblolly pine is a little less site exacting. Plantings of this species, even outside its natural range showed greater growth than the other pines. Best growth was found on non-eroded sites and on granitic soils. Virginia pine growth showed less variation than the other five species on the site conditions studied. White pine grew best on sites having little erosion and on granitic soils.

For the best yellow-poplar development, an uneroded, deep-soil site is required. The best growth was found on soils derived from shale parent material. Black locust is a very site exacting species. Plantings on the most severely eroded sites showed very poor growth. Growth was much better in gully bottoms and on sites having no erosion.

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# Pollen-Dispersion Studies: Some Practical Applications

**Jonathan W. Wright**
Geneticist, Northeastern Forest Experiment Station, U. S. Forest Service.

*It is generally assumed that tree pollen travels great distances. But recent studies of pollen-dispersion distance show that pollen of some forest trees travels only a few hundred feet. The author outlines practical uses for information about the pollen habits of some forest trees.*

IN SELECTING TREES to leave as seed sources, the forester usually thinks about the distance of seed dispersion, the chances of seed trees blowing down, and the tolerance of the prospective seedlings. In some instances he should also think about the distance that tree pollen travels.

It is generally assumed that pollen travels great distances—10 miles or more. But if the pollen travels only a few hundred feet—and the pollen of some species does just that—then pollen-dispersion distance becomes an important factor in spacing residual seed trees.

Obviously seed trees cannot be of much practical value if they are spaced so far apart that they cannot be pollinated.

Another practical use for information about pollen-dispersion distance is in planning seed orchards, for sources of reliable seed for reforestation purposes. And of course the geneticist can make use of such information in numerous ways.

## A Study of Pollen Dispersion

A study was undertaken to determine pollen-dispersion distances for several forest tree species. Part of the study was made in the vicinity of West Lafayette, Ind., while the author was instructor in forestry at Purdue University. Part was made at the University of Pennsylvania's Morris Arboretum in Philadelphia, as a cooperative project in the Northeastern Forest Experiment Station's genetics research.[1]

The species studied were ash (*Fraxinus americana* and *F. pennsylvanica* var. *lanceolata*), Douglas-fir (*Pseudotsuga taxifolia*), poplar (*Populus deltoides* and *P. nigra* var. *italica*), elm (*Ulmus americana*), Norway spruce (*Picea abies*), Atlas cedar (*Cedrus atlantica*), Lebanon cedar (*Cedrus libani*), and pinyon (*Pinus cembroides* var. *edulis*). Details of the study are given in a previous report (*11*).

Isolated trees were used as sources of pollen. Where possible, trees were chosen that were far enough from others shedding similar pollen at the same time so that there would be no contamination. This ideal condition was found for Lombardy poplar, Douglas-fir, and pinyon; but contamination was encountered with other species.

Pollen traps (microscope slides coated with vaseline or, in one experiment, glycerine jelly) were set up at varying distances from the source trees. For elm trees the traps were run to east and west; for ash and Douglas-fir, west and south (the wind was mostly from the northeast). For other species the traps were run to all four compass points.

The pollen traps were collected at intervals of one or more days, and the pollen grains were counted at magnification of 100x in open air, without staining. In critical cases a magnification of 440x was used. On each microscope slide an area of 3.86 square centimeters was counted (1.86 square centimeters for cedar and pinyon).

From the pollen counts, standard deviation was calculated as a measure of dispersion distance. This term may be unfamiliar to some foresters. So may some of the other concepts used here: calculation of subpopulation size and degree of isolation in continuous populations in which there is no apparent isolation; the calculation of the breeding population, which includes a small proportion of the total number of trees; etc. The interested reader will find them fully explained in recent publications of Sewall Wright of the Department of Zoology, University of Chicago (*12, 13, 14*), and in modern treatises on evolution.

The procedures for calculating the standard deviation of pollen-dispersion distance ($\sigma_D$) were outlined by Sewall Wright. To obtain $\sigma_D$ the data were fitted to a logarithmic transformation of the curve represented by the formula (*1*)—

$$y = y_o e^{-kD}$$

in which y and $y_o$ are the frequencies at a given distance (D) and zero respectively, and k is a constant relating to the decrease in dispersion rate with distance.

$$\sigma_D = \sqrt{2/k}$$

## Results

### Dispersion Distances

The dispersion distances for the species studied, expressed as $\sigma_D$, are as follows:

| | $\sigma_D$ Feet |
|---|---|
| Ash | 55-150 |
| Douglas-fir | 60 |
| Poplar | 1,000 or more |
| Elm | 1,000 or more |
| Spruce | 130 |
| Atlas cedar | 240 |
| Lebanon cedar | 140 |
| Pinyon | 55 |

The results for ash, Douglas-fir, Atlas cedar, Lebanon cedar, and pinyon are fairly accurate. But because of either excessive contamination or the small amount of pollen dispersed, the dispersion distances calculated for poplar, elm, and spruce are subject to considerable error. The values for elm and poplar may range from several hundred to several thousand feet. Despite this large possible error, it is certain that the dispersion distances for poplar and elm are considerably greater than those of the other species.

[1]The author gratefully acknowledges the help given by staff members of Purdue University and the Morris Arboretum.

### Influence of Wind and Other Factors

Average wind velocity did not seem important in pollen-dispersion distance. In no cases were the dispersion distances much greater on windy days, and there were three instances in which dispersion distances were slightly lower on very windy days than on relatively calm days. However, with the true cedars wind velocity did determine the amount of pollen dispersed; more pollen was caught on cold, windy days than on warm, calm days. This is because the male strobili of *Cedrus* is stiff and erect and must be shaken vigorously to dislodge the pollen.

As expected, there was a marked correlation between wind direction and direction of pollen disperson. Pollen counts were lowest in the windward quadrants.

Topography also seems to have an influence on direcion of spread. Little pollen was caught on the uphill sides of the source trees. In most cases, however, the effects of wind direction and topography were confounded.

Size of pollen grain had a slight effect on disperson distance. The very large round pollen grains of Douglas-fir traveled only short distances, as did also the large winged pollen grains of spruce, pine, and cedar. This did not hold true for ash, which has a very small pollen grain; ash pollen traveled much shorter distances than the somewhat larger pollen of poplar and elms.

The air sacs of some coniferous pollen grains are frequently credited with helping to carry the pollen long distances. As a matter of fact, the sacs contract in dry air (*3*) and they are probably more useful in orienting the pollen grain in the fluid secreted by the female flowers during the pollination process (*2*).

These data fit best the theoretical curves based on calculations made by Gregory (*4*). He places great emphasis on air turbulance—in both dispersing and depositing pollen—and practically ignores wind velocity, but not wind direction. The data do not fit at all theoretical curves based on the assumption that the trajectory of each pollen grain can be calculated from data on the rate of fall, distance of fall, and wind velocity.

TABLE 1.—EXPECTED CONTAMINATION IN SEED ORCHARDS SURROUNDED BY ISOLATION STRIPS OF DIFFERENT WIDTHS

(All distances are given in terms of σ, which is, for ash 55 to 150 feet, Atlas cedar 240 feet, Lebanon cedar 140 feet, pinyon 55 feet, Douglas-fir 60 feet, Norway spruce 130 feet, elm and poplar 1,000 feet or more.)

| Width of isolation strip | Percentage of contaminating pollen at distances inside seed orchard of— | | | | |
|---|---|---|---|---|---|
| | 0 | 0.5 σ | 1 σ | 3 σ | 5 σ |
| | Assuming equal pollen production by all trees | | | | |
| 1 σ | 61.6 | 15.4 | 6.1 | 0.31 | 0.020 |
| 2 σ | 28.0 | 4.2 | 1.6 | .076 | .0049 |
| 3 σ | 8.7 | 1.0 | .38 | .020 | .0012 |
| 5 σ | .57 | .065 | .020 | .0012 | .00007 |
| 10 σ | .0005 | .00006 | .0.002 | .000001 | .00000007 |
| | Assuming pollen production per tree 1,000 times as great for outside as for inside trees | | | | |
| 5 σ | 85.1 | 39.4 | 20.0 | 1.2 | 0.07 |
| 10 σ | .5 | .06 | .02 | .001 | .00007 |

## Practical Applications

### Spacing of Seed Trees

For regeneration cutting most foresters now recommend patch or strip clear-cuttings, selection cuttings, the reservation of blocks of seed trees, or leaving a rather large number of scattered seed trees. If four or five large seed trees per acre are left, the effect of pollen-dispersion distance can be safely ignored.

In cutting mixed stands that contain relatively few trees of the desired species, the forester should plan to leave a specified minimum (probably three to five) number of large trees per species per acre to allow for cross-fertilization of all ovules. The number to be left can be calculated from pollen-dispersion data.

Take, for example, a mixed hardwood stand. Considerations of seed dispersion, probable windfall, sunscald, etc., may call for leaving ten trees per acre, including one tree per acre of white ash. This means a spacing between male and female ash of about 300 feet. With such a spacing about 1 percent of the ovules will be pollinated and produce seed. But if the number of ash left is increased so that there is only 200 feet between male and female trees the percentage of ovules that are pollinated will be increased 15-fold. Much more ash reproduction can be obtained from the same number of parents by leaving the parents in groups rather than as scattered trees. (These figures apply to heavily pollinating males of the same size as were used in the present study.)

The pollination habits of the species must also be considered. In a species such as white pine, in which the female development is precocious, adequate seed production would not result no matter how many cone-bearing—but non-pollinating—young trees were left. Leaving one old pollinator per acre would increase seed set greatly.

### Seed Orchards

Seed orchards are used to mass-produce seed for reforestation purposes. In its simplest form, the seed orchard may be a better-than-average natural stand from which cull trees have been removed. With further developments in tree breeding, it will be a plantation of progeny-tested élite trees.

Ten or twelve seed orchards may be needed for one species. For practical reasons it may often be necessary to locate them fairly close together. Then contamination must be considered. Pollen-dispersion distance can be used as a guide in isolating seed orchards to prevent contamination.

*Isolation.*—Expected contamination in seed orchards surrounded by isolation strips of different widths is given in Table 1. These values were calculated on the assumption that the wind blows in only one direction, that the trees are equally spaced (0.1 σ apart),

and that the trees are self-compatible. Increasing the value of $\sigma$ by 20 or 30 percent will probably counteract any errors introduced by these assumptions.

With isolation by only 1 $\sigma$ there is considerable contamination. With isolation by 3 $\sigma$ there is only 9 percent contamination in the border rows and very little inside. Such narrow isolation strips might be used when it is necessary to establish several seed orchards close together. Isolation by 5 $\sigma$ results in very little contamination even in border rows. This is probably a safe isolation distance when the pollen production is the same inside and outside the stand — for example, in élite mature stands reserved for seed production.

Newly planted seed orchards will for several years produce less pollen per tree than will mature stands outside. This will increase the amount of contamination. Isolation by 10 $\sigma$ will reduce contamination to less than 1 percent in any part of the seed orchard if the ratio $\frac{\text{pollen per outside tree}}{\text{pollen per inside tree}}$ is as large as 1,000. If the ratio is much larger than this (because newly planted trees produce little pollen), lack of pollination will preclude useful seed crops for a few years.

*Size and arrangement of orchard.* — Pollen frequencies are much lower in a small seed orchard. This can be calculated from the pollen-dispersion data, as follows:

| Distance inside orchard from windward border | Pollen frequency as percentage of highest frequency in an infinite stand |
|---|---|
| | *Percent* |
| 0 | 0 |
| 0.4 $\sigma$ | 51 |
| 1 $\sigma$ | 79 |
| 2 $\sigma$ | 95 |
| 3 $\sigma$ | 99 |

Orchards 1$\sigma$, 2$\sigma$, and 3 $\sigma$ wide receive respectively about 53, 70, and 79 percent of maximum possible pollination. Thus better seed sets can be expected from a larger planting.

Furthermore, male and female trees should be associated as intimately as possible to insure full pollination. This is indicated by the following tabulation of pollen frequencies at varying distances from a single source tree.

| Distance from single source tree | Relative pollen frequency |
|---|---|
| | *Percent* |
| 0 | 100 |
| 0.5 $\sigma$ | 59 |
| 1 $\sigma$ | 24 |
| 1.5 $\sigma$ | 12 |
| 2 $\sigma$ | 5.9 |
| 3 $\sigma$ | 1.4 |
| 4 $\sigma$ | 0.35 |

These remarks apply mostly to young orchards of spruce and some pine species that would produce cones abundantly for several years before they produced enough pollen to insure a 100-percent seed set. With increasing age and pollen production wider spacings can be tolerated.

### In Forest Genetics Work

Pollen-dispersion data provide a basis for determining what constitutes isolation. This has several important applications in forest genetics work.

*Collecting seed.*—Isolated trees as a whole should be avoided in seed collecting. They are almost worthless as sources of seed that is typical of the species.

From perfectly isolated trees one can get seed that is empty, selfed, or hybrid. Empty seeds are of course worthless. Selfed seeds are often worthless too, because selfed progeny are generally below normal in vigor. And relatively few trees throw large amounts of hybrid seed naturally.

Isolation should be measured by the distance between flowering trees; it should take into account the pollen production per tree. From pollen-dispersion data, seed production at varying distances from pollen sources can be estimated (Table 2).

When it is impossible to avoid using isolated specimens as seed sources, cutting tests should be used soon after collecting to eliminate lots of seed that are mostly empty. Seed lots from such trees should be labelled so that the user can judge how typical the seeds are.

*Controlled pollination.*—In ordinary controlled pollination work, bags are used to cover the flower and keep out unwanted pollen. This insures seed of known parentage. Isolation may serve the same purpose. Using isolated trees rather than bagging may reduce working time 90 to 95 percent.

The very trees that are least useful as sources of normal seed are the most useful for this kind of controlled pollination work. Although completely isolated trees are rare, there are in the Philadelphia area hundreds of specimens that to open pollination produce only 1/5 — or even 1/20 — of the seed that could be expected from intraspecific crosses. For certain purposes (large-scale production of easily identified hybrids, for example) a small amount of contamination is not serious. Results can be checked against orthodox pollination experiments.

A small-scale experiment was made in 1949 to determine whether the observed seed sets on isolated trees were really due to lack of pollination. Some unbagged branches on each tree were subjected only to wind pollination; others were given additional hand pollination. The increased seed sets due to the additional hand pollination were as follows:

| Species | Increased seed set due to additional hand pollination |
|---|---|
| | *Percent* |
| *Pinus strobus* | 1,100 |
| *P. parviflora* | 100 |
| *P. griffithii* | 200 |
| *Picea glauca* | 1,800 |
| *P. abies* | 400 |

TABLE 2.—EFFECT OF DISTANCE FROM POLLEN SOURCE ON SEED SET

| Species | Estimated receptive area | | Expected seed set at given distances to leeward of a single pollen source tree | | |
|---|---|---|---|---|---|
| | Per flower | Per ovule | 100 feet | 200 feet | 500 feet |
| | *Square mm.* | *Square mm.* | *Percent* | *Percent* | *Percent* |
| Ash | 1 | 1 | 100 | 15 | 0.03 |
| Atlas cedar | 360 | 0.94 | 100 | 100 | 21 |
| Douglas-fir | 450 | 5.6 | 60 | 6 | 0.004 |

*Race formation.*—In estimating probable race formation, four factors must be considered: selection pressure, population size, isolation, and mutations. Most racial studies to date have been based almost entirely on selection pressure. Pollen-dispersion data provide information about population size and isolation.

Some isolation is necessary for race formation. Otherwise incipient races are swamped. There are genetic isolating mechanisms such as polyploidy and segmental interchange, which allow two varieties to develop side by side. However, high fertility in the few interracial crosses that have been made indicate that in most tree species the isolating barrier is spatial rather than genetic. Gaps (oceans, lakes, deserts) in discontinuous populations and distance itself in continuous populations serve as isolating barriers.

Estimating the size of the breeding population and the degree of isolation has been made possible only recently by the work of Sewall Wright (*13*, *14*). He takes the "neighborhood" (largest population within which breeding takes place at random) as the basic unit. The number of breeding individuals in the neighborhood (N) is determined by population density and the distance of pollen (and/or seed) dispersion. One of the following formulas is used:

1. For linear continuity, equal dispersion of seed and pollen—
$$N = 2\sqrt{\pi}\,\sigma_D d$$
2. For areal continuity, equal dispersion of seed and pollen—
$$N = 2\pi\sigma_D^2 d$$
3. For linear continuity, pollen only dispersed—
$$N = \sqrt{2\pi}\,\sigma_D d$$
4. For areal continuity, pollen only dispersed—
$$N = 4\pi\sigma_D^2 d$$

—in which N is the number of breeding trees in a neighborhood and d is the number of flowering trees per linear foot of linear range or per square foot of areal range.

These formulas are for hermaphroditic populations. For dioecious populations the formulas for the effective number of male trees are the same as above for equal dispersion of seed and pollen.

Table 3 gives an example of neighborhood sizes as calculated from dispersion distance. Here there was assumed to be no seed dispersion. If seed- and pollen-dispersion distances are equal the neighborhood size is doubled.

From neighborhood size the effect on race formation can be interpreted (*13*, *14*). If N is small, gene interchange is slow and the population is free to break up into races through natural selection and inbreeding. If N is large, gene interchange is rapid and the effects of selection pressure are dissipated among all parts of the population.

With small pollen-dispersion distance and neighborhood, one would expect to find frequent unbridged gaps in the range of a species, and distinct local and geographic races—even in the essentially continuous deciduous forests of the eastern United States. As an example, according to these data Douglas-fir has excellent chances for race formation.

With large pollen-dispersion distance and large neighborhood, such as those indicated for elm and poplar one would expect rapid interchange of genes between adjacent subpopulations, and little race formation.

Some writers have assumed that differences in latitude and altitude affect race formation the same way. This is true for selection pressure, but not for isolation. There is much more rapid gene interchange between two nearby points separated by a 1,000-foot difference in elevation than between two points 250 miles apart. Hence one should expect altitudinal races to be much less distinct than geographic races.

Racial studies that have been made tend to support these theoretical conclusions. Well-differentiated geographic, and possibly local, races have been found in white and green ash (*5*, *9*, *10*). Pinyon has four varieties that are sometimes considered to be distinct species. A great amount of geographic raciation has been found in Douglas-fir (*6*), and European reports indicate geographic races in Norway spruce.

On the other hand, poplar raciation appears to be on a broad geographic scale. Cottonwood is fairly uniform over the northern part of its range, but a distinct race is discernible in the Gulf States (*7*). Elm has not been studied.

The question of altitudinal versus geographic races has been attacked in ponderosa pine studies by the California Forest and Range Experiment Station. Plantings show undoubted genetic differences between stocks from different elevations in the same county. However, the differences are less than those between geographic races described by Weidman (*8*).

These theoretical generalizations as to where one should or should not expect race differentiation are not a substitute for empirical progeny tests. But they should be helpful in planning and interpreting such tests.

TABLE 3.—POPULATION STRUCTURE OF SOME FOREST TREE SPECIES

| Species | Type of range (linear or areal continuity) | Estimated density of breeding population | Pollen-dispersion distance[1] ($\sigma_D$) | Neighborhood size |
|---|---|---|---|---|
| | | *Trees per acre* | *Feet* | *Trees* |
| Green ash | Linear, 200 feet wide | 25 | 55 | 22 |
| White ash | Areal | 10 | 55 | 9 |
| Elm | Linear, 200 feet wide | 10 | 2,200 | 262 |
| Poplar | Linear, 200 feet wide | 10 | 2,000 | Many |
| Douglas-fir | Areal | 50 | 60 | 26 |
| Atlas cedar | Areal | 25 | 240 | 207 |
| Pinyon | Areal | 25 | 55 | 11 |

[1]For purposes of computation, a single value within the probable range was chosen.

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# Control of Medusa-Head on California Ranges

**Paul Furbush**
Forest technician, California Division of Forestry, Santa Rosa, Calif.

FIG. 1.—Dense stand of medusa head on sample plot on the Potter Valley area before burning.

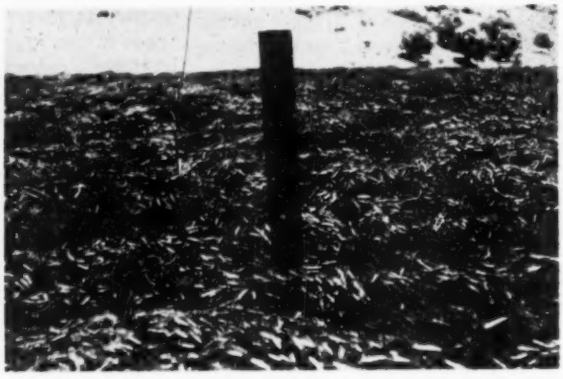

FIG. 2.—Sample plot on Potter Valley area (same as Fig. 1) after burning. Blades and culms of the grass were almost entirely consumed and the panicles scorched by the fire.

MEDUSA-HEAD (*Elymus caput-medusae L.*) is an aggressive weedy annual grass, native to the Mediterranean region. It was introduced into this country in the 1880's and now is a well established pest on range lands of several northern California counties.

The plant generally has been considered by ranchers as another variety of "foxtail" and its pernicious qualities considerably underestimated. For this reason, no attempts were undertaken to control its steady spread until recent years. In the 1930's, it became apparent that the invader was taking over extensive areas, crowding out desirable species of forage plants and of itself offering little or nothing as livestock feed.

Early infestations continue to spread out over large areas of range lands; widely scattered "beach heads" are being discovered with somewhat alarming regularity. These point to a growing need for control and prevention measures. Preliminary results of studies by the California Division of Forestry in Mendocino County indicate that fire, under controlled conditions, can be used successfully in reducing medusa-head infestations on northern California ranges.

## Description and Distribution

Medusa-head is a low, slender annual grass with narrow blades, and nodding spikes bearing bristly awns two to four inches long. When green, the awns are straight and closely grouped; on drying, they twist and spread erratically, giving the spike its fancied resemblance to the mythical Medusa's head.

Medusa-head matures later than associated annual plants (*1*). As they dry the plants bleach out rapidly to a very light shade that is conspicuous against the darker surrounding vegetation. The contrast of the green plants in early summer, and their much lighter color late in the season, facilitate quick recognition of infested spots. Forage on surrounding areas is grazed much shorter, making patches of medusa-head conspicuous by their height, further aiding detection of infestations.

The first specimen of medusa-head to be received by the University of California Herbarium, was collected near Roseburg, Oregon, in 1887. The university obtained

its first California specimen in 1903, when one was collected at Round Mountain, Klamathon, Siskiyou County. During the 1930's, additional collections were made in Trinity, Shasta, and Lake Counties.[1]

Local accounts place the initial appearance of medusa-head in Mendocino County as being some five miles east of Ukiah, California, in the vicinity of Vichy Springs. It was known to occur here about 1932. The invader spread north and west; by 1940, it formed dense stands over a considerable area of foothill range in Potter Valley and Redwood Valley.

Today the plant is know to occur in California as far south as Placer and Solano counties (*1*) and has been reported from Los Gatos in Santa Clara County (*2, 3*). The main centers of infestation in the North Coast include Mendocino, Humboldt, Sonoma, and Lake Counties. In this area, an estimated total of 100,000 acres of range land is affected. In the northeastern part of the state, Shasta and Siskiyou County ranges support widespread stands, and it has been reported from Modoc and Trinity Counties. This grass occurs also in Idaho and Washington (*1*).

During the early years following introduction of the new grass into California ranchers gave it various names, such as "goat grass," "wild barley," and "foxtail."

## Significance in Range Management

Medusa-head is dispersed to distant ranges chiefly in the coats of grazing animals, especially in the wool of sheep, and possibly in their intestinal tracts as well. Once a small patch is established, both wind and water spread the seed locally. One area was observed where seed was carried more than ten feet up hill during a single season by the prevailing winds. Once it has gained a foothold, medusa-head spreads rapidly, seed from the initial invasion giving rise to secondary infestations throughout the adjacent range. Characteristically, it forms a dense cover to the exclusion of other grasses. Broad-leaved herbs, such as bur clover (*Medicago hispida*) and filaree (*Erodium spp.*) are more persistent in competition with it.

Invasions are most common on ranges in poor condition, but all ranges dominated by annual plants appear susceptible to infestation. While overgrazing and similar unfavorable management practices may accelerate the rate of spread, there is as yet no assurance that grazing practices alone will prevent an invasion.

In early spring medusa-head is taken limitedly by all classes of livestock, especially where it is associated with more desirable forage such as filaree, bur clover, Spanish clover (*Lotus americanus*) and soft chess (*Bromus mollis*). Despite its late maturity, it makes no significant contribution to the forage crop, except on heavily infested ranges where little else is present. As soon as the seed heads appear, infested areas are avoided by livestock. In addition to its low palatability, the long-awned spikes cause considerable mechanical injury to mouth, nose and eyes of grazing animals, especially among sheep.

## Studies of Control Methods

Medusa-head, like other annuals, is entirely dependent upon seed production for each year's propagation. This fact suggests that control can be effected if the seed crop is destroyed before maturity.

Since medusa-head remains green from two to four weeks after associated plants have matured seed, it appeared that control measures applied during this period would have least effect on desirable forage species. Mowing, application of temporary soil sterilants, and use of fire under controlled conditions offered possibilities as control methods. The difficulty and costs of using equipment on the steep slopes where medusa-head so often occurs, limits the applicability of mowing or chemicals.

By late May or early June, the medusa-head seeds are in the "milk" or "early dough" stage. Associated annuals have cured to a point where they will readily carry a light fire, yet one of sufficient intensity to burn through the slender culms of medusa-head, arresting the process of seed development.

For these reasons, it appeared that fire, under controlled conditions, might afford an effective, economical method of controlling medusa-head, through destruction of the seed crop.

It has been observed also, that late summer wild fires have greatly reduced Medusa-head stands, indicating a limited ability of matured seed to withstand high temperatures.

The first work on this problem was done in 1948 as a cooperative project between the California Division of Forestry, represented by Associate Ranger William A. Jamieson, and Ray Schultz, a rancher in Redwood Valley, Mendocino County. The present study is an outgrowth of this early work.

The Schultz ranch is typical of a major portion of the range land in the north coast region of California. It lies between the valley crop lands and the chaparral zone, at an elevation of approximately 1,000 feet. Average rainfall here is about 35 inches; the growing season averages a little over 200 days. Summers are hot and extremely dry, while winter temperatures usually are mild. Predominant vegetation is woodland-grass. This ranch has been used almost exclusively as yearlong sheep range during the last ten years.

In early June of 1948, Jamieson and Schultz controlled-burned 120 acres of a moderately dense medusa-head stand on the Schultz ranch in Redwood Valley. In the summer of 1949 this area showed that medusa-head had been almost completely eliminated. The only medusa-head plants in evidence at that time were in gullies or similar sheltered spots not reached by the fire. This area still was relatively free of the pest in the summer of 1951.

[1]Personal correspondence, 1951.

A few small patches of medusa-head had reappeared inside the burned area; desirable forage plants such as bur clover, soft chess and filaree dominated where medusa-head formerly was abundant.

The encouraging results of this trial led to establishment of plots for detailed study in 1950 and further field trials in 1951.

In 1950, two one-tenth acre fenced plots were established on the Schultz ranch for detailed study. These plots were located on a moderate slope in a heavy stand of medusa-head, typical of infested areas in this locality. One plot was controlled-burned; the other was left unburned as a check area.

During June 1951, three field trials were made to determine the effectiveness of controlled burning in reducing infestations. The first of these was to control this grass on 160 acres of heavily infested range in Potter Valley. In the second, two areas were burned on the University of California Experimental Ranch near Hopland, for the purpose of eradicating small, isolated patches of medusa-head. The third controlled burn treated seven acres of an extremely heavy medusa-head stand on the Buckhorn Ranch, near Willits.

The method of conducting the burning operation on the Potter Valley area could be applied to the average situation where fire is used for medusa-head control. The area treated was level to gently rolling land (Fig. 1). Except for a few scattered live oaks, the range was free of woody vegetation. A road, and a gully bare of vegetation, furnished adequate fire lines along 75 percent of the perimeter These lines were connected by a firebreak, constructed with a disk pulled by a light farm tractor. Preparation was completed in three hours, by one man, including travel to and from the area to be burned.

Two four-man crews were used for burning. Each crew was equipped with two McLeod tools and two five-gallon back pumps. The crews started from a common point on the leeward side and worked in opposite directions. One man in each crew set the fire, spreading it with the McLeod tool; the second man with a McLeod tool was employed in raking hot particles away from the line and preventing spread of the fire across the line. The two back pump operators in each crew were assigned primarily to guard against fires starting over the line from sparks, but they also assisted in mop-up action where necessary.

This burn was started at 10:00 a.m. and completed at 1:00 p.m. After two additional hours of patrol, the area was considered safe and the last man left. This controlled burn was completed with a total of 30 man-hours of labor and three hours of tractor use, including preparations.

The fire burned slowly and evenly down hill. Blades and culms of the grass were almost entirely consumed by the fire; the medusa-head panicles were scorched but left scattered about the ash more or less intact (Fig. 2).

When burning was commenced the weather conditions were: Temperature 80° F.; relative humidity, 45 percent; wind, about one mile per hour from the southwest. By noon the temperature had risen to 90° F. and humidity had dropped to 30 percent. This noon weather combination is too severe for burning for medusa-head eradication in most situations. A very satisfactory burn can be obtained with average temperature of 60° to 70° F., and average relative humidity of 40 to 50 percent.

## Results

The two fenced plots established in 1950 exhibited a striking contrast by the summer of 1951. The burned plot was free of medusa-head, except along the upper and lower margins; heavy rainfall during the previous autumn had washed some seed downhill into the upper portion of this plot, and upslope winds carried seed into the lower margin of the burned portion. Nitgrass (*Gastridium ventricosum*) and silver hairgrass (*Aira caryophyllea*), both characteristic of the early plant succession following burning in this locality, were the most abundant plants on the burned plot; soft chess and Spanish clover, both valuable forage species, were present in lesser amounts. There was no change in vegetation on the unburned plot; it consisted almost exclusively of medusa-head. By early spring of 1952, the burned plot was revegetated with a good cover of soft chess and Spanish clover, the nitgrass and silver hairgrass having nearly disappeared.

It is still too early to ascertain fully results on the larger areas treated in 1951. Examination in April and June 1952, indicate that the medusa-head was effectively removed, and show evidence of its replacement by desirable forage species.

Surrounded as they are with a dense stand of medusa-head, complete reinfestation of small plots can be expected within a few years. Applied to an extensive acreage, however, there is no reason why range units cannot be reclaimed from medusa-head stands and returned to full productivity. Followup treatment may be required to mop-up small patches missed by the fire.

## Recommendations for Control

By reason of its low quality and general unsuitability as a forage species, and because of its ability to replace more desirable range species, it appears that a program of prevention against the further spread of medusa-head is highly justified. Observing a few basic rules can do much towards preventing or retarding the spread of this noxious plant on range land.

1. Learn to identify the medusa-head plant and inspect ranges carefully for invasion spots. Detection of new patches should be followed by early eradication, either by burning, by the application of chemicals or by mowing.

2. The season of use can be adjusted so grazing of animals will assist in control. Heavy grazing of infested areas during the green stage should be permitted, followed by complete isolation after the seed head forms.

3. The coats of grazing animals purchased at auction yards should be examined before releasing on clean range, unless the buyer is assured that stock came from uninfested area. Stock purchased from areas known to be contaminated, should be kept in holding pens for a day or two as a precaution against spread of seed via the intestinal tract.

### Summary

Medusa-head, a weedy annual grass, has become established on Northern California ranges. Preliminary results indicate controlled burning to be an economical, effective method of reducing infestations; mowing and chemicals may have a place in the control program. Its spread to new areas may be minimized by proper handling of livestock. Ranchers in this area should familiarize themselves with this plant to facilitate its early detection and control.

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# Do Age of Mother Trees and Age of Cones Affect Development of Young Jack Pine?

**Paul O. Rudolf and R. A. Ralston**

Respectively forester at St. Paul, Minn., and research forester at East Lansing, Mich., Lake States Forest Experiment Station.

ACCORDING TO POPULAR OPINION, it is best to collect seed from middle-aged trees. Seed of very young and very old trees is often considered to be low in viability and to produce stock of poor quality. Yet very little research has been done to prove or disprove these popular conceptions.

Jack pine (*Pinus banksiana*) is one of the principal pines in the Lake states and has been planted on more than 600,000 acres, largely on poor sites. There still remain over 3 million acres in need of planting for which jack pine is the most suitable species.[1] Therefore, there will continue to be a need for large-scale collection of jack pine seed for many years. Consequently, any information which can help to simplify seed procurement will be of practical value to seed collectors, nurserymen and forest managers.

Jack pine has two characteristics which can make seed collection easy: (1) Cone production begins at an early age; trees less than 10 years old often produce relatively numerous viable seeds; and (2) over much of its range the cones often are serotinous, making it possible to harvest several years' seed production at one time. A question of practical significance is whether or not the seeds from trees of different ages and cones of different ages produce trees of equal value. Reported here are results of some studies which shed light on this question.

### Age of Mother Tree

The best known study of the effect of age of mother trees on the resulting progeny was that of Busse in Germany.[2, 3] In 1912 he collected seed from Scotch pine parent trees of six different age classes ranging from 16 to 170 years. The resulting stock was field-planted in the spring of 1915, and observations on the plantation were reported in several published articles. Although there were minor differences in the growth and survival of the stock from mother trees of different ages, they were in no case very large. The general conclusion seemed to be that there was little important difference in progeny resulting from different ages of mother trees. One factor which made comparisons between the different lots of stock somewhat uncertain was that all parent trees were not of the same seed source. Although the two oldest age classes were of natural reproduction, the rest were plantation grown and the origins of several were different.

### Jack Pine Mother Trees Studies

The effect of age of mother tree on seed and stock characteristics of jack pine was studied in two small experiments undertaken on the Huron National Forest in lower Michigan in 1935 and in 1937. The first was initiated by the Lake States Forest Experiment Station and the second by the national forest as an administrative study.

*1935 Study.*—In the fall of 1935 cones of the current year's crop were collected from the tips of jack pine trees of the following age classes: 1 to 10 years, 11 to 20 years, 21 to 40 years, 41 to 60 years, and 61 years and older. Beyond 60 years jack pines in this locality are essentially overmature. All the seed trees were located within a 10-acre tract which is level

[1] Rudolf, Paul O. The reforestation job in the Lake States—a new estimate. Lake States Forest Experiment Station Paper No. 4. 1946.

[2] Busse, J. Welchen einfluss übt das Alter der Mutterkiefer auf die nachkommenschaft? (What influence does age of pine mother tree have upon the progeny?) Zeitschr. f. Forst-u-Jagdwesen, 56(5): 257-286. 1924. U.S.F.S., Div. Silv., Trans. No. 76, Oct. 1934.

[3] Busse, J. Welchen einfluss übt das Alter der Mutterkiefer auf die nachkommenschaft? (What influence does age of pine mother tree have upon the progeny?) Zeitschr. f. Forst-u-Jagdwesen, 58(1): 72-83. 1926. U.S.F.S., Div. Silv., Trans. No. 197, Oct. 1934.

TABLE 1.—YIELD, SIZE, AND VIABILITY OF SEEDS FROM CONES PRODUCED BY JACK PINE MOTHER TREES OF DIFFERENT AGES—1935 COLLECTION

| Mother tree age class | Average seeds per cone | Cleaned seeds per pound | Sound seed | Laboratory germination 30 days |
|---|---|---|---|---|
| *Years* | *Number* | *Number* | *Percent* | *Percent* |
| 1-10 | 29 | 127,000 | 88 | 56 |
| 11-20 | 31 | 117,000 | 91 | 58 |
| 21-40 | 24 | 132,000 | 98 | 61 |
| 41-60 | 19 | 139,000 | 97 | 60 |
| 61+ | 15 | 148,000 | 96 | 57 |
| Average total sample | 24 | 133,000 | 94 | 58 |

TABLE 2.—FIRST-YEAR SURVIVAL AND CAUSES OF LOSS—1935 STUDY

| Mother tree age class | Survival | Mortality by causes | | |
|---|---|---|---|---|
| | | Heat | Poor planting | Smothering |
| *Years* | | *Percent* | | |
| 1-10 | 97.5 | 1.5 | 0.5 | 0.5 |
| 11-20 | 97.5 | 1.5 | 1.0 | 0 |
| 21-40 | 96.5 | 2.3 | 0.3 | 0.9 |
| 41-60 | 99.0 | 1.0 | 0 | 0 |
| 61+ | 98.0 | 1.0 | 0.5 | 0.5 |
| Average | 97.7 | 1.4 | 0.5 | 0.4 |

and has a uniform soil classed as Grayling fine sand. Since the trees were all of natural origin and were growing under uniform site conditions within a small area, the chances are reasonably good that the different age classes were genetically comparable. A total of 100 cones was collected from at least five different mother trees in each age class.

There were some differences between age classes in the number of filled seeds per cone. Generally cones from the youngest trees had more seeds than those of the older trees in progressive order (Table 1). There was also a general trend toward decreasing seed size with age of mother tree. However, there was very little difference in soundness or laboratory germination among the seeds from mother trees of different ages.

Seed of the various age classes were sown in the Beal Nursery at East Tawas, Mich. in the spring of 1936. The trees were transplanted once and field-planted in the spring of 1938 as 1-1 stock. Stock grown from seed of the oldest age group averaged slightly, but not significantly, smaller than that of the other groups.

The 1-1 jack pine was planted in small subplots of 40 trees each. There were five replications with a total of 200 trees per age class. They were planted at a spacing of 5 by 5 feet in furrows by the barslit method. The planting site is a level, open area of Grayling fine sand less than a mile from the parent stand on the Mio District of the Huron National Forest. The area had been burned over and denuded of tree cover by a severe fire in 1927. Previously there had been an open stand of jack pine on the area.

Weather conditions were favorable during the first year after planting, and as a result, survival was very good, ranging from 96.5 to 99 percent for the various age classes (Table 2). The small amount of mortality was attributed primarily to high soil surface temperatures. Some mortality resulted also from improper planting and smothering of the trees by sand or litter.

Survival and height growth were measured at the end of 4 and 8 years after planting, or 6 and 10 years from seed (Table 3). Weather conditions continued to be relatively favorable, and there was very little mortality. At 4 years after planting survival for the various age classes ranged from 95.5 to 98.0 percent. At the end of 8 years, the range was only 95.5 to 97.5. There were only minor differences in height growth between the different age classes. Four years after planting the various lots ranged from 3.1 to 3.4 feet in average height. Although these differences were small, statistical analyses revealed that the two tallest lots (11 to 20-year age group and 41 to 60-year age group) were significantly larger than the other lots at the 1-percent point. Four years later the range of average heights between lots was from 7.8 to 8.1 feet. Height differences were still small and at this age were not significant statistically.

TABLE 3.—SURVIVAL AND GROWTH 4 AND 8 YEARS AFTER PLANTING (6 AND 10 YEARS FROM SEED)—1935 STUDY

| Mother tree age class | Survival | | Average height | |
|---|---|---|---|---|
| | 1941 | 1945 | 1941 | 1945 |
| *Years* | *Percent* | *Percent* | *Feet* | *Feet* |
| 1-10 | 97.5 | 97.0 | 3.2 | 7.9 |
| 11-20 | 97.5 | 97.5 | 3.4[1] | 8.0 |
| 21-40 | 95.5 | 95.5 | 3.1 | 7.8 |
| 41-60 | 98.0 | 97.5 | 3.4[1] | 8.1 |
| 61+ | 97.0 | 97.0 | 3.1 | 7.9 |
| Average | 97.1 | 96.9 | 3.2 | 7.9 |

[1]Differences between these and the other age classes are significant at the 1 percent point.

In the spring of 1946, before the ninth year of development of these plantations, they were destroyed by a severe fire which swept through the area. Consequently, it is impossible to follow the development of this experiment any further. Indications at the age of 10 years from seed, however, were that there were no significant differences either in survival or height development between the trees which were produced from seed gathered from mother trees of different age classes.

*1937 Study.*—The second test was started by the Huron National Forest on the Tawas District in the fall of 1937. At this time newly matured jack pine cones were collected from trees ranging in age

from 10 to 80 years growing in apparently similar stands in several localities on the Forest. For this reason, it cannot be established without reasonable doubt that the parent trees were genetically comparable and that any differences in progeny development could be solely attributable to age of mother tree. However, since the trees were all native and were growing on similar sites within a limited locality, it is probable that they were genetically similar.

Several differences were found between age classes even before the field portion of the test was started, namely, in the number of cones per bushel and the number of filled seeds per cone. The general trend was toward more cones per bushel (smaller cones) with increasing age of mother tree. The number of filled seeds per cone gradually decreased with age of parent tree, but no definite trend was noted with respect to the percentage of sound seeds per age class. Germination tests were not successful because of injury to the seed during extraction.

Seeds of the various mother-tree age groups were sown in the Beal Nursery, East Tawas, Mich. in the spring of 1938. The 2-0 seedlings were lifted from the seedbed in May 1940 and 20 sample trees were selected at random from each lot for measurement. Top length, root length, green weight of tops, green weight of roots, and average stem diameter at ground level all varied somewhat from class to class and showed no consistent relationship with age of parent tree. All stock used in the field test was within prescribed quality standards used on the national forest at that time.

In the spring of 1940, 50 sample seedlings from each age class were planted at a spacing of 5 by 5 feet in adjacent furrows by the bar-slit method. Thus, each of the seven 250-foot long furrows contains one lot of trees. The planting site is a level area of Grayling sand typical of the jack pine soils in the locality. A scattered stand of small northern pin oak saplings provided a partial overstory shade. The plot area is small, and both soil and cover are uniform.

TABLE 4.—SURVIVAL AND GROWTH 1 AND 12 YEARS AFTER PLANTING (3 AND 14 YEARS FROM SEED)—1937 STUDY

| Mother tree age class | First year survival | Twelfth year | | |
|---|---|---|---|---|
| | | Survival | Growth | |
| | | | Average height | Average d.b.h. |
| *Years* | *Percent* | *Percent* | *Feet* | *Inches* |
| 11-20 | 100 | 96 | 13.9 | 2.0 |
| 21-30 | 100 | 98 | 13.9 | 2.0 |
| 31-40 | 100 | 98 | 14.0 | 1.9 |
| 41-50 | 98 | 94 | 13.8 | 1.9 |
| 51-60 | 100 | 94 | 13.7 | 1.9 |
| 61-70 | 98 | 96 | 13.9 | 1.9 |
| 71-80 | 100 | 94 | 13.6 | 1.9 |
| Average | 99 | 96 | 13.8 | 1.9 |

Because of favorable moisture and temperature conditions during the first growing season in the field, survival was excellent, ranging from 98 to 100 percent for the various age classes (Table 4). White grubs accounted for the slight loss.

Survival percentage, diameter increment, and total height growth were determined by examination and measurement at the end of 12 years after planting, or 14 years from seed (Table 4). Weather conditions continued to be favorable during the intervening years, and only a few trees were suppressed by the competing oaks, so that mortality was very slight. Twelve years after planting, survivals ranged from 94 to 98 percent. Differences in both diameter increment and height growth between lots were not statistically significant at this time. Average total heights ranged from 13.6 to 14.0 feet while the average diameters at breast height were between 1.9 and 2.0 inches. Thus, the small variations evident at the time of planting have apparently averaged out during the 12 years that the trees were growing into sapling size.

## Cone Studies

Jack pine cones often remain on the trees unopened for 10 or more years in the northern part of the Lake States. Studies in Minnesota have shown that even the oldest of these cones retain substantial quantities of viable seed although there may be a significant decrease in germination in seed from cones more than 3 years old.[4] This decrease is due in part to an increase in the percentage of empty seeds which normally, however, would be removed in the extraction process. More than half the available jack pine seed on an area may be in cones 5 years of age and older.[5]

Although studies have shown that there is viable seed in the older jack pine cones, there has been a lack of evidence as to the kind of stock produced from seed of such cones. Accordingly, the station initiated a study in 1935 to clarify this question.

All the cones were collected from an acre of 65-year-old jack pine on the Chippewa National Forest, Minnesota. The cones were sorted into four age groups: 1 year old, 2 years old, 3 to 4 years old, and 5 years and older. Laboratory tests showed that seeds of all age groups were high in soundness and that germinative capacity dropped some in seed from cones 3 to 4 years old and decreased markedly in seed from cones 5 years and older (Table 5). Some seed of each age group was sown in the Cass Lake Nursery in the spring of 1936 and grown to 1-1 stock.

In the spring of 1938, 1,600 transplants were planted 5 by 5 feet apart in scalps on the site which formerly supported the parent stand. The planting stock, representing four equal lots from seed

[4]Schantz-Hansen, T. A study of jack pine seed. Jour. For. 39(12): 980-990. 1941.

[5]Anonymous. Lake States Forest Experiment Station Research Digest. Sept.-Oct., p. 5. 1936.

TABLE 5.—SEED CHARACTERISTICS OF JACK PINE CONES OF DIFFERENT AGES

| Age of cones | Cleaned seeds | | Laboratory germination |
|---|---|---|---|
| | Per lb. | Soundness | |
| *Years* | *Number* | *Percent* | *Percent* |
| 1 | 135,629 | 95 | 74 |
| 2 | 130,044 | 90 | 77 |
| 3-4 | 121,608 | 95 | 64 |
| 5+ | 114,905 | 96 | 30 |

TABLE 6.—GROWTH OF JACK PINE ORIGINATING FROM CONES OF DIFFERENT AGES

| Age of seed in 1935 when sown | 14 years' growth | |
|---|---|---|
| | Average total height | Average d.b.h. |
| *Years* | *Feet* | *Inches* |
| 1 | 16.5 | 2.2 |
| 2 | 16.4 | 2.3 |
| 3-4 | 16.3 | 2.2 |
| 5+ | 16.5 | 2.3 |

of each age class, was established in a Latin-square design with four replications.

Twelve years after planting (or 14 years from seed) average heights ranged from 16.3 to 16.5 feet and average diameters from 2.2 to 2.3 inches for the trees grown from cones of different ages (Table 6). These differences are very small and not significant.

Cone production of the trees started from seeds of different ages has been quite uniform, and no apparent effects of seed age have developed.

## Conclusions

The results of two tests of jack pine grown from seed produced by mother trees of different ages and one test of jack pine grown from cones of various ages collected from a mature stand indicate no significant differences in progeny 10 to 14 years old. It appears safe, therefore, in the northern Lake States to gather jack pine cones up to 5 years old from trees of any age so long as they are of satisfactory form and development.

However, there are some practical limitations to the application of these findings. For example, trees below 20 years in age seldom yield a very heavy crop of cones although the cones are quite easy to pick. On the other hand, overmature trees (more than 60 to 80 years old in this locality) often produce rather poor crops composed mostly of small cones. Since the small cones produce fewer and smaller seeds than those which are larger and the smallest seeds produce somewhat smaller nursery stock than average, trees of the overmature age group are less desirable as a source of seed than those which are under 60 to 80 years. Normally it is also desirable to collect cones which are not over 3 years old because the yield of good seeds is usually lower from the older cones. Where the serotinous character of the cones is not established, those older than the current crop may contain little or no seed because of previous dispersal.

Despite these limitations, young jack pine grown from seed collected from mother trees ranging in age from 51 to 80 years and cones up to 5 years of age apparently will not differ appreciably in growth and quality.

All government,—indeed, every human benefit and enjoyment, every virtue and every prudent act,—is founded on compromise and barter.

EDMUND BURKE

# Notes

## Simple Devices Aid Use of Aerial Photographs

The writer is one of the many foresters who, after years of working with timber surveys the hard way, dragging a chain over mountains and through swamps, saw the possibilities of aerial photographs and promptly fell in love with them. With a stereoscope a forester can find in a pair of photographs information otherwise visible only to an aerial observer. The greatest obstacle has been to translate this pictorial encyclopedia into usable maps and facts. Most of the instruments which have been built for these purposes are so complicated and expensive that they have been beyond the reach of the average forester. What is more they have surrounded aerial photos with a veil of mystery which has made men pass them by as too difficult to use. If this veil could be torn away foresters could do their work with far greater ease and efficiency. We present here three simple tools which a forester can construct himself so that he can use aerial photos in his work. Similar instruments on the market cost from $50.00 to $500.00, but this expense is unnecessary. With these basic tools a forester can put aerial photos to practical use.

### A Magnifying Mirror Stereoscope

Everyone is familiar with the most elementary tool, the folding stereoscope, consisting of a pair of magnifying glasses in a frame. It is not entirely satisfactory, as only a narrow strip between two overlapping photos can be viewed at one time. This makes it difficult to get a general view of the entire overlap of a stereo-pair. That suggests mirrors to spread the photos farther apart so that the entire overlap will be visible. Fig. 1 shows the result of my attempt to "do it with mirrors." Four mirrors are needed, two small ones for eyepieces and two larger ones to catch the reflection of the photos. Ordinary mirrors, such as the small "vanity" mirrors to be found in every woman's handbag, may be used although first-surface optical mirrors are much better. Ordinary mirrors have the silver on the back of the glass and this frequently causes a double image. This is caused by a reflection from the front surface of the glass, especially if the light is dim. Optical first-surface mirrors may be obtained at small cost from mirror manufacturers, and they give a sharp, brilliant reflection. These four mirrors are cemented to a wood frame at 45° to the line of sight. A pair of large magnifying glasses, such as the old fashioned reading glass, about 4 inches in diameter, should be mounted under the mirrors. This type of stereoscope gives a fine clear view of the photos, and it may be moved around over the entire overlap. It is particularly adapted to getting an overall view of a stereoscopic pair before starting detailed examination, and for use with large photographs such as 9x18's and 18x18's, where a lens stereoscope is almost useless. It may be used for such jobs as interpreting timber types or stand classes, which may be outlined on the photo with a colored pencil. I use this as the first step in preparing timber maps.

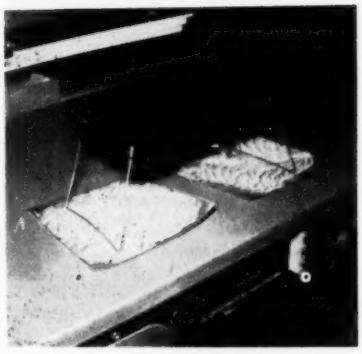

FIG. 1.—A magnifying mirror stereoscope.

### A Binocular Stereoscope

Ocasionally high magnification is needed for more difficult interpretation jobs and a binocular stereoscope is needed. These instruments can be found on the market priced upwards of $125.00. A forester can make one with his own binoculars and $2.00 worth of adapter lenses. A pair of 350 mm. focal length lenses, which may be obtained from any optometrist, are placed under the retaining rings of the objective lenses of the binoculars. This shortens the focus to about 12 inches. The binoculars are then attached to a holder which is illustrated in Fig. 2. This stereoscope may be used for such difficult jobs as distinguishing between pine and fir, where the shape of the tree top, whether round or conical, is the only indicator. The binoculars may be restored to their original form at a moment's notice.

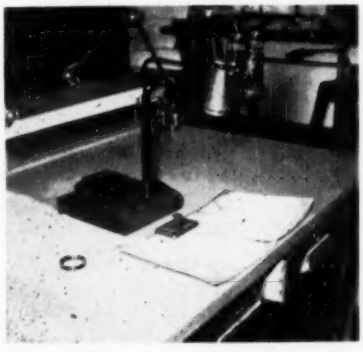

FIG. 2.—The binocular stereoscope, showing compensating lens and detached retaining ring in foreground.

### A Plotting Machine

The forester needs a plotting machine next to transfer the type lines from the photos to his maps. I devised this instrument, which I call the Multiplotter because it can do so many jobs, after seeing the vertical sketchmaster in operation during World War II. The sketchmaster is an arrangement of two mirrors, one only lightly silvered so that it is semi-transparent and the other completely silvered. The operator looks into the partially silvered mirror and sees a reflection of a photograph and, at the

same time, looks completely through the mirror and sees a map. The result is to superimpose the photograph on the map and enables the operator to draw what he sees in the photograph on the map. My objection to this instrument was that it used single photographs, thus producing a flat image instead of taking advantage of the third dimension which a stereoscope gives. The obvious remedy was to use two such instruments together so that stereoscopic vision would be possible. The result is seen in Fig. 3. I built this apparatus in a ranger station barn with only the ordinary carpentry tools which were at hand. It was built from scraps of plywood salvaged from old signs to which the mirrors were cemented, a lighted photoholder, and tripods made from telephone pole bolts. The adjustable tripod is needed so that differences in scale and distortion between the photos and the map may be compensated. The instrument looks complicated but in reality it is very simple, and it could be built by anyone familiar with stereoscopes. It takes less than 5 minutes to adjust a pair of photos so that they are superimposed on the map, and after this adjustment is made the other photos in the same flight line may be adjusted in less than a minute. I have used this instrument for 6 years and have tested it under a large variety of conditions, taking it down and reassembling it frequently. Its greatest value to the forester is in transferring timber type lines and proposed road locations from photos to a base map with great accuracy, permitting interpretation of the terrain and logging conditions at the same time. Its greatest weakness is that it does not compensate for relief displacement in very rough country.

However, the vertical sketchmaster, or any one of several other camera-lucida type instruments which are on the market, will give satisfactory results, although at greater cost.

Here are a few examples of the jobs this type of plotter can do. In 1946 our regional office of the

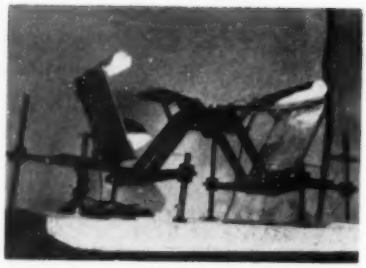

FIG. 3.—The multiplotter set up over a base map and ready to use in plotting timber types.

Forest Service had an unexpected opportunity to acquire a 90,000-acre tract of timberlands in northern New Mexico through land exchange. We had no good maps of the tract and very little information about the timber, most of which was inaccessible. My Forest Supervisor asked me to put my plotting machine to work and in two weeks we had a detailed type map which has been used ever since. Later sample plots were measured in each type and an estimate of the timber was made.

In 1950 one of our timber operators had need for an emergency timber sale on short notice. In a day's time I was able to get enough stand data to determine, after plotting the desired area on a base map, that 1,500 M board feet could be cut from it. The timber was sold on this basis and later cut out 1,449,980 feet. Shortly afterward another tract, known as the Wild Horse Unit, was estimated by these methods at 1,750,000 feet and was advertised and sold on this basis. This was an area of very rough and complex topography, much of which required an uphill haul, making it necessary to estimate on the photos which slopes were too steep to log. It cut out 1,721,260 feet. Four other larger sales are now in the process of cutting and there are indications that they will also cut out very close to their estimates.

There are several reasons why accurate estimates can be made with this instrument. First, while the stand per acre is estimated roughly from random sample plots the accessible area is delineated very accurately, unless there is considerable topographic displacement in the photos. Second, all barren and unmerchantable areas are accurately excluded. Third, differences in stand stocking can be accurately plotted.

Having become so dependent on these three labor-saving devices it is difficult to see how any forester can handle a heavy volume of timber business without them. In my opinion, foresters who are still using the older, more time-consuming methods work at a great disadvantage.

G. R. HEATH,
*Gila National Forest.*

## Comments

As pointed out by Mr. Heath there is a need for some simple and relatively inexpensive devices to aid foresters in their use of aerial photographs. Mr. Heath proposes three devices to meet this need. The writer has been asked to comment briefly on each.

### Magnifying Mirror Stereoscope

Most simple mirror stereoscopes being sold commercially in this country cost in excess of $200 when equipped with a magnifying lens system. This obviously is many times the cost entailed by Mr. Heath in constructing a stereoscope with four "vanity mirrors" and a pair of "old fashioned reading glasses." The greater cost of the commercial instrument is attributable both to the higher quality of its component parts and to the greater care and precision with which these parts are aligned to form the instrument's optical chain. As a result, the commercial instrument usually permits a photo interpreter to perceive the stereoscopic image more clearly and with less eyestrain than can be achieved with improvised instruments. However, when using an improvised stereoscope (particularly one equipped with front surface mirrors which minimize ghost image effects) the photo interpreter may not notice appreciable loss of image quality unless he attempts to observe very fine detail in the stereo model. Similarly he may not notice

appreciable eyestrain unless he uses the improvised equipment for prolonged periods of time.

In view of the foregoing there would appear to be numerous situations in which a magnifying mirror stereoscope of the type devised by Mr. Heath will be sufficient to meet the needs of a forest photo interpreter. On the other hand there also will be numerous situations which will justify investment by the forest photo interpreter in the finest stereoscope that commercial manufacturers can produce.

### The Binocular Stereoscope

As in the previous instance, there is a need here for considering the optical suitability of the improvised system for photogrammetric use. When "two dollars worth of adapter lenses" are placed in front of the field lenses of the binoculars, (as proposed by Mr. Heath), all aberrations in the uncorrected adapter lenses are transmitted and magnified by the binocular system. This condition may completely nullify most of the good optical qualities of the binoculars themselves. If the optical center of each binocular lens is not carefully aligned to that of the corresponding adapter lens, indeterminant and variable prismatic distortions may result. Apparently such distortions were not serious in the case of Mr. Heath's binocular stereoscope. He reports to the writer that on one occasion he used the instrument intensively, eight hours per day, for a continuous period of three weeks and experienced no appreciable eyestrain.

The question of economy also must be critically examined in this instance. If the employment of field binoculars as components of a stereoscope prevents their being used in the field (as originally intended by both their designer and their purchaser) a false economy may have been achieved. Such a conflict arises when both a photo interpreter and a field man wish to use the same binoculars at the same time.

As evidence that binocular stereoscopes of the type proposed by Mr. Heath are satisfactory for meeting the requirements of certain situations, it is worthy of note that during World War II the German army made frequent use of field binoculars as field stereoscopes.

### Stereoscope Plotting Machine

Mr. Heath is to be complimented for the ingenuity which he exercised in the construction of this machine. The results which he obtained with the machine provide adequate testimony as to its usability, although the question of possible eyestrain to the operator should be raised here as in the previous examples. In this connection it should be stated that a rotation of any optical element of his plotting machine about any of its three axes might make it virtually impossible for a layman subsequently to align the optical system properly for binocular vision.

Relative to the question of economy, if the two vertical sketchmasters (which sell for approximately $150.00 each) must be purchased and used exclusively for this instrument, their cost may exceed that of commercially produced planimetric plotters, some of which sell for as little as $250-$300 each.

In summary two points seem worthy of emphasis:

(1) The forest photo interpreter who makes frequent use of aerial photographs or who studies them intensively for prolonged periods of time owes it to himself to procure commercially produced stereoscopic equipment of high quality. Only by so doing can he minimize eyestrain and extract the maximum potential from the photographs.

(2) The forest photo interpreter who makes only occasional use of aerial photographs and who does not study them intensively for prolonged periods of time will do well to improvise photogrammetric equipment, as Mr. Heath has done, rather than to leave largely unexploited the wealth of data derivable from aerial photographs of the forest.

ROBERT N. COLWELL,
*School of Forestry,*
*University of California.*

## Menominee Reservation Timber-Wildlife Crops[1]

Anyone wondering about the ways of outdoor management can collect a lot of positive data on the Wisconsin Menominee Indian reservation where the Indians carefully manage their forests and hunt game when and how they please around the year to maintain an outdoor paradise.

This reservation, as was the common story, came to the Indians because no one could find a better use for it. It consists of 234,000 acres and today holds about 3,000 Indians.

The reservation follows the philosophy of harvesting rather than saving trees. There is a museum forest that for years has been the admiration of visitors but the question is now being considered as to whether these 150-foot trees should be left to deteriorate or be brought under the same economic management that prevails generally over the reservation.

Management of the reservation is centered on wood products and the annual timber crop produces more than 95 percent of the reservation income. But the annual cut is limited to 20,000,000 board feet, figured on a sustained yield basis. The probability is that the cut is conservative and that more timber is growing back annually than is taken off. The Indians process their own timber at their Neopit mill and sell their lumber on the open market. The harvest does not materially change the appearance of the red men's forest. The taking of a mature tree here and there does bring in a bit more sunlight and stimulates the growth of close and sizeable neighbors. The cutting program helps maintain a wildlife habitat.

Officials agree that if the land and its vegetative progression can be maintained there is little need to worry about the wildlife on it. Nobody now worries about wildlife. There are no game laws. With

[1]Adapted from a release of the Wisconsin Conservation Department.

year-around trapping permitted without any restrictions, beaver survived the era of high-priced pelts and are so numerous that they sometimes prove troublesome in timber operations.

Any Indian can take deer whenever he is inclined to and as many as he is able to. But most of the Indians take their venison through the fall and up to Christmas. Some of the Indians do hunt at other times of the year. Wildlife technicians do not think that Indian hunting may in time eradicate the deer of the reservation. As long as the deer productive machinery can be kept in high gear the animals will be there.

The deer herd on the reservation is held down well within the limits of their preferred food. As a result the best deer foods have a chance to grow and if the Indians ever let up on their hunting the animal population would probably explode to wreck both deer and forests. Deer now drift into the area from the surrounding country where hunting is restricted because nowhere else can deer find the choice foods available on the Indian lands.

What the Indians do with their game within the reservation is their own business. There have been some reservation suggestions against shining deer at night but there are no actions against this practice. The Indians commonly hunt deer with dogs. There are no records as to the number of deer or other game the Indians take in the course of a year.

The reservation is said, by forestry personnel, to be producing a lot of yew, a preferred deer food that is practically being eradicated in the rest of the state's deer country. Deer browse heavily on this. There is no reservation browse line and the forest floor carries an abundance of brushy plants well within the reach of deer. The reservation has no winter starvation of deer.

There was a time when the reservation freely issued trout fishing permits to outsiders but that day is passed. For one thing the visitors were apt to start a forest fire and the Indian has come to appreciate his own trout fishing without a crowd of white neighbors.

There is talk now that this reservation is no longer needed, as the Indians are fairly well assimulated into the general population. Under such a plan, the area would become a part of Wisconsin and be subject to its laws and regulations. The Menominees have been considering this eventuality. Should the reservation be abolished, they may form a cooperative and try to continue the management that has demonstrated its success.

## A Silvical Study of Certain Factors Contributing to the Differential Height Growth of Plantation-Grown Tulip Poplar[1]

A comprehensive silvical study of plantation-grown tulip poplar (*Liriodendron tulipifera* L.) was conducted at the Fred Russ Experimental Forest in Cass County, Michigan, during the growing seasons 1951-2. This investigation included the results of both field and laboratory studies in an effort to determine the silvical requirements of plantation-grown tulip poplar. A knowledge of the growth habits of this species under the climatic conditions of southwestern Michigan seemed advisable. In the vicinity of the experimental area there is a large number of farmers and private land owners who are interested in converting abandoned farm land to tree growth as a continued investment. Since tulip poplar is a desirable species from the standpoint of economical reforestation, the present study was initiated to determine the feasibility of recommending tulip poplar for such an enterprise.

The research work was carried out on a 15 year old 20-acre tulip poplar-catalpa plantation. Observation of the tulip trees in this particular plantation reveal a marked differential rate of height growth on trees of the same age and density. This difference in height growth is associated with the presence of an old-growth hardwood stand adjoining the plantation on the south and west. The experimental area was arbitrarily divided into two distinct sites (Area X and Area Y) for research purposes. Edaphic (physical and chemical), microclimatic, and quantitative soil microbiological data were obtained at the same sampling plots in both sites. The approach to the investigation was to determine what factor or set of factors were contributing to the marked differential height growth of plantation-grown tulip poplar.

Laboratory experiments on the physical-edaphic factors of the compared sites revealed only two properties of any actual and statistically significant difference. These two related factors, the amount of fine clay and the water-holding capacity of the $A_1$ and $A_2$ soil horizons, were the only physical-edaphic factors which differed significantly between Area X and Area Y. Ten physical-edaphic properties were studied in detail and treated statistically by analysis of variance. The physical soil factors investigated in relation to height growth were soil texture, specific gravity, volume weight, porosity, hygroscopic coefficient, water-holding capacity, moisture equivalent, soil evaporation loss, depth of lateral root penetration, and the water table fluctuation.

A statistical treatment of seven important chemical-edaphic factors in each area indicated no outstanding actual or statistically significant difference between the areas of good and poor height growth of tulip poplar. Further verification of the lack of any chemical soil difference was substantiated by a study of seven individual major nutrient elements.

[1]An abstract of a thesis presented in partial fulfillment of the requirements for the degree of Doctor of Philosophy in the School of Graduate Studies of Michigan State College of Agriculture and Applied Science, Department of Forestry, 1952.

A growing season study of seven microclimatic factors in relation to soil factors of both areas indicated in virtually every case that the integrated elements of evaporation, relative humidity, air temperature, surface soil temperature, percent available moisture, and light intensity, were closely related to the marked differential height growth of tulip poplar, insofar as these factors conditioned the soil-moisture regimen. Supplemental studies on growth rates, sunscald, bark thickness, herbaceous plant succession, and soil microbiological counts further substantiated the effect of microclimate on soil-moisture requirements.

The continuous soil-moisture regimen throughout the growing season was found to be the principal limiting factor contributing to the marked differential height growth of plantation-grown tulip poplar.

ROBERT DEAN SHIPMAN.

## Young Virginia Pine Responds to Thinning and Pruning

Virginia pine is less capable of pruning itself than most other yellow pines. This tendency of the tree to keep its limbs almost indefinitely has prevented its attaining even moderate rank as a producer of high-grade lumber.

Yet when Virginia pine does produce clear wood, the lumber is comparable to that from other yellow pines.

To determine whether pruning and releasing crop trees in young Virginia pine stands would help them on their way to growing clear lumber, a study was made on the Beltsville Experimental Forest at Laurel, Md. The results after 7 years bear out the value of pruning and releasing selected crop trees.

*The Study.*—In a 9-year-old Virginia pine stand, 320 potential crop trees about 16 feet tall and 3 inches in diameter at breast height were selected for study. The stand was divided into five blocks, each containing 64 trees as uniform in size and shape as possible.

In each block, 16 trees were pruned, 16 were released, 16 were both pruned and released, and 16 received no treatment at all.

Pruning was done in the conventional manner to a height of 7 to 9 feet. An average of 38 percent of live crown was removed. Most of the limbs removed were from ¼ to ¾ inch in diameter. They were cut as close to the trunk as possible.

The release treatment was essentially a light thinning, in which the neighboring competitors around the selected crop trees were removed.

Five years later, the diameters at breast height and the total heights of the selected trees were measured and the effects of the different treatments were compared.

*The Results.*—The growth of the young Virginia pine trees for the 5-year period after thinning and pruning was as follows:

| Treatment | Five-year growth D.b.h. | Height |
|---|---|---|
| | *Inches* | *Feet* |
| No treatment | 1.4 | 10.9 |
| Thinned | 1.9 | 11.0 |
| Pruned | 1.2 | 10.8 |
| Thinned & pruned | 1.7 | 10.8 |

The light thinning, which released the selected trees from their competing neighbors, had a stimulating effect on diameter growth. The treatment had no significant effect on height growth.

Pruning caused a reduction in diameter growth for the 5-year period after pruning. However, by the sixth growing season the crowns of these trees had developed to about the same size as the trees that were not pruned; so it is assumed that the diameter growth did not affect height growth. has returned to normal. Pruning

The diameter growth of the trees that were both pruned and released was significantly greater than the diameter growth of trees that received no treatment, or had a pruning treatment only.

Five years after treatment, 97 percent of the selected young Virginia pines were still potential crop trees. Practically all pruning wounds had healed. The trees were growing clear wood over the ends of the knots where the limbs were cut off.

Seven years after treatment, the pruned-and-released trees had grown enough to warrant a second pruning to remove all limbs to about the height of the first sawlog.

*Recommendations.*—On the basis of these preliminary studies, the following treatments are recommended to the owner of a young Virginia pine stand who wants to grow high-grade sawlogs:

1. When the stand is about 10 years old, select the crop trees to be carried through to sawlog size.
2. Prune the selected trees to about the height of the first half log (8 feet), removing not more than one-third of the live crown.
3. Release the pruned trees to allow a 3- to 4-foot space between the crowns of the selected trees and their neighbors. The crowns will grow together in 2 to 3 years.
4. About 7 years later, complete the pruning of the butt log, and again release the crop trees.

M. J. WILLIAMSON,
*Northeastern Forest Experiment Station, Upper Darby, Pa.*

## Logging Problems in Management and Use of the High-Elevation True Firs[1]

There are a great number of problems confronting the logger in every type of timber to be found in the forests of California but in all probability the combination of problems is most acute in those areas where the high-elevation true firs occur in quantity. From the time the forester makes his first recon-

[1] A paper presented before the Annual meeting of the Northern California Section, Society of American Foresters, at Oakland in December 1952, as part of a panel discussion. Russell P. McRorey, Timber Sales, Region V, U. S. Forest Service, preceeded this paper with his views on appraisal and marking, while Carl S. Walker, general manager of the Feather River Pine Mills, Inc. followed with a talk on manufacture and sales.

naissance through the stands for road location until he has completed checking the area for erosion control work; and from the time a faller sizes up his first swell-butted, spike-topped and cankerous fir tree until the last sinker log has been cleared from the mill pond; loggers are constantly coming face to face with problems due primarily to the fact that they are operating in the high-elevation true fir country.

In considering these problems, two groupings seem obvious: (1) Accessibility, and (2) Merchantability.

Accessibility is for all practical purposes a road building job assigned to loggers, though in a few cases where volumes indicate the need of more extensive road systems, the construction is accomplished separately. Merchantability is a more complex problem and perhaps the more important of the two. Certainly no one who inspects a recently cut red fir area and sees the high percentage of cull logs, long-butts and slash remaining on the ground could fail to recognize the overwhelming economic losses incurred in such logging.

(1) Access to and penetration of the high-elevation true fir areas is no average problem. These areas lie largely in rugged country near the crest of the mountain ranges where topographic features are anything but encouraging to loggers. The extreme distance of the timber stands from centers of population sufficiently large to supply the necessary labor force is another pressing problem. Establishment of camps in the back country becomes a prerequisite when timber stands are located 30 miles or more from the mill. Some of the areas are three times that distance from the destination of the logs.

Roads are actually being built into these areas but in most cases it appears that the cost of construction is applied to adjacent timber stands comprised of the more valuable species. Private logging roads such as Winston Lumber Company's in the Carson Pass area and the Fibreboard Products' in the Truckee area are being pushed into the high-elevation true fir stands while the U. S. Forest Service Access Roads such as Calida's near Downieville and Associated Box's in the Modoc country, are making it possible to reach formerly inaccessible stands. These roads are not inexpensive to build; on the contrary, they are run through a variety of the most rugged types of topography to be found in the state. Granite is a common obstacle to road progress south of the Yuba Pass, while lava reefs and large boulders are hinderances found in all the areas.

Perhaps a most important consideration is the shortness of the logging season at these high elevations. It is seldom that logging can begin before the first of July and in most years logging equipment must be out of the snow belt by the first of November. This leaves about four months per year for actual road construction and logging operations.

(2) The merchantability of the species in this type of stand is a subject for much discussion in the field, where the problem crops up so frequently in the form of *breakage* and *defect*.

Breakage is of particular seriousness in the high-elevation fir stands. These firs show a marked brittleness and brashness when compared with the white fir in the lower and middle elevations. The stand density, which is for the most part high, is a cause of some breakage where trees must be felled across or on top of others. Where the density is not so high, the rough ground is an equal cause of breakage. Defect is an indirect cause of breakage in that fallers must frequently fall trees with cat faces in a direction not the most suitable for a good lay or for breaking out during the skidding operation.

Defect in these species appears in many forms, similar but much more serious than that found in the lower elevations. Heart shake is exceptionally common and often affords easy avenues for the spreading of the heart rots and top rots. Top rots are also found in large numbers, their spread through a tree being somewhat unpredictable but usually extensive, necessitating extra care in bucking and sometimes considerable sounding before the best means of utilization are determined. Cankers are a lesser problem in most of these areas, and butt rots, though common, do not extend into the tree very far. There are a few areas where the butt rot and a top rot have merged, leaving only a thin shell of sound wood for most of the length of the tree. Quite often it is impossible to tell from the exterior indications that a tree has reached such a state of decay. The red fir shows a greater tendency to look good while actually being quite rotten than does the white fir in the same stand. In one area, 70 percent of the trees had to be long-butted an average length of 24 feet. Crook is another type of defect which affects the efficiency of falling as well as the utilization of the tree, but becomes an even more serious problem later in the logging cycle.

Scaling logs of this type requires considerable knowledge, and careful inspection, if cull and cull logs (delivered) are to be kept to a minimum. The place for cull is in the woods, preferably where it fell, but in any case not loaded on the trucks. Where logs are not culled before skidding, particularly in those areas of high cull percentage, it is only a short time before landings become clogged. Then, after logging is completed, the logger finds that not only are the cull logs considered unsightly when bunched around a landing, but so also are those left in the woods. In these high-elevation areas where recreation holds a high priority, it is certainly understandable that a clean show be left behind by the loggers; and this only adds emphasis to the necessity of culling logs and trees where cut. A successful program to accomplish this end would be largely directed at the falling and skidding crews. More intelligent falling practices and a greater degree of supervision

of bucking seems necessary. Where the cull left in the woods reaches 50 percent of the faller's scale (gross), as it does in many of these areas, it is obviously feasible to double up on the bull-bucking crew so as to permit more time for close inspection and marking of cull timber. An assistant bull-buck (or more as required) is a necessity and is already the practice of a few companies.

Skidding of logs is also effected adversely by the conditions in this type of forest. The density makes it nearly impossible to save much of the reproduction, which is often sparse, or the reserve trees still standing. The large amount of cull logs and snags on the ground further hamper efficient yarding practices. Loading of logs which are often crooked is naturally more costly.

The peculiarities of these species follow management even into the pond and deck storages at the mill. Sinkers and bobbers are often the main reasons for lost time on a truck haul where unloading is slowed or stopped while the pond immediately under the brow log is cleared. In log decks where these species, and particularly the red fir, are stored for any length of time, the presence of both insects and fungi is soon evident. Serious damage to the sapwood portions of the logs is caused by both agents while the heartwood is not much affected. Worm holes and white pocket rot in the sapwood are common in the moist and shady parts of log decks within one month of decking.

It is the U. S. Forest Service that administers large areas of the high-elevation true firs and to the shaping of Forest Service timber sale policies in these areas we must look for the answers to the many problems inherent in the logging operation. Consideration of these problems by those concerned with appraisals, whether they be government or private timber managers, will greatly increase the prospects for a more complete utilization of timber values in these areas. Attitudes of indifference on the part of management will do nothing to increase values in these stands but will instead tend to create an economic hurdle, thereby discouraging prospective loggers and eliminating the possibilities of making sanitation and initial silvicultural cutting.

A balance between accessibility and merchantability on the one hand and stumpage rates and logging practices on the other must be reached, and *soon*, if we are to realize our goal of maximum utilization of this natural resource.

HARRY ABRAHAM,
*Forester,*
*Foresthill Logging Company,*
*Foresthill, California.*

## Area of Tree Farms Grows

At the close of business December 31, 1952 a total of 4,172 tree farms were listed by the American Forest Products Industries Washington office. These 4,172 units represented 27,659,100 acres of privately-owned tax-paying woodlands, all managed for the continuing production of timber crops. The AFPI chief forester, James C. McClellan, estimated that about 70 percent of the country's tree farmers are small nonindustrial land owners. During 1952 two new states, South Dakota and Maine, joined the tree farm system bringing the total number to 35. A thirty-sixth state, Iowa, will launch its program early in 1953. Last year, a total of 753 new tree farms with 3,028,539 acres were inspected and certified by foresters representing sponsoring agencies in the participating states. At the same time, 56 tree farms with 181,885 acres were dropped during 1952 because of changes in ownership status or failure to maintain required management standards. Since the start of the tree farm program 11 years ago 215 units have been withdrawn for these reasons.

# Reviews

**The Story of Trees.**

By Ferdinand C. Lane. 384 pp. Illus. Doubleday & Company, Inc., Garden City, N. Y. 1952. $5.

*The Story of Trees* might best be described as a miscellany. The late Aldo Leopold once wrote that he was amazed by the diverse character men impute to one and the same tree. Dr. Lane has gathered into one volume the imputations of many men in many ages. Men of science, of literature, and of the arts, all contribute something to this book. The author's own lively prose threads together an array of quotations, tales, and facts about trees.

The book's arrangement may remind some readers of the 1949 yearbook of the Department of Agriculture, *Trees*. Its topical pattern progresses in somewhat the same fashion, from the aesthetic and historical to the scientific and utilitarian developments which give trees their prominent place in the world's economy. Chapter contents have little perceptible organization. Each one opens with a quotation from a classic or near-classic. Literature lovers will find favorite authors represented. Tennyson, Wordsworth, Milton, Virgil, Thoreau, and Dante are only a few.

For his technical material in sections on forest products, Dr. Lane evidently uses reputable and current sources, though he does not cite these sources bibliographically. He avoids the mistake of some popular writers on plant life, who try to explain complicated physiological processes about which plant scientists themselves may still be in the dark. A weary-eyed proofreader let Swetonia pass for the generic name of mahogany, but on the whole the book is free from errors.

The author has been described in reviews of previous books as a teacher of journalism and as a world traveller. Readers who have enjoyed these books about the mountains, the seas, and great rivers, will be glad to know that Dr. Lane has "done it again," this time with trees for his subject.

FRANCES J. FLICK.

**Soil Microbiology.**

By Selman A. Waksman. 356 pp. Illus. John Wiley & Sons, Inc., New York 16, N. Y. 1952. $6.

Professor of soil microbiology at Rutgers University, Dr. Waksman is director of the Microbiological Institute that bears his name. His achievements in the field of antibiotics have recently won him the Nobel Prize. The distinction bestowed upon him is not confined to the individual; its international recognition spreads over the very fields of his activity—microbiology and soil science.

Dr. Waksman is among the few laureates who are men of science as well as letters. His present book is a filtered and re-crystalized product of scores of technical papers, and three voluminous texts: *Principles of Soil Microbiology*, *Humus*, and *The Soil and the Microbe*. In a way, the book may be likened to a microbiological culture which has undergone a certain period of incubation and several transfers—all to attain a synthesis of the scientific truth with the clear, direct presentation of facts.

The contents of the text are well outlined by the author's preface: "This is a book about the life in the soil, the soil under our feet, the soil in which our cultivated and uncultivated plants grow and from which they derive most of their sustenance, and which in their turn support animal life, including that of man himself." The 16-chapter account of the life in the soil includes a historical review of microbiology, composition of soil population, and descriptions of specific organisms occurring in the soil. This is followed by discussions of the decomposition of plant and animal residues in soils and composts, formation of humus, evolution of carbon dioxide from decomposing organic matter, transformation of nitrogen, fixation of nitrogen by nonsymbiotic and symbiotic organisms, and alterations of mineral substances by microbes.

Further chapters deal with the relationship of higher plants and soil organisms, associative and antagonistic behavior of soil population, disease producing organisms, manures, composts, green manures, and effects of microorganisms on soil fertility. The book is closed with a survey of the recent developments in soil microbiology. All these facts and relationships are treated with regard to the four principal aspects of soil microbiology — ecological, physiological or biochemical, agronomical, and pedogogical.

Among the news items that are of a direct concern to silviculturists one should mention the recently discovered ability of red root, silver berry, alder, and sweet gale to fix atmospheric nitrogen. It is probable that future research will reveal this highly useful characteristic in many other "undesirable" members of a forest comunity. The concentration of microbes in the rhizosphere, associative and antagonistic behavior of soil population, and the maintenance of the microbiological equilibrium—all deserve the attention of silvicultural research. Foresters may well note the author's warning against different "all crops" innoculants, such as cultures of free nitrogen-fixing bacteria, certain fungi, earthworms, etc., (p. 324). The same holds true about his word of caution in regard to over-enthusiasm for the biological methods of parasite control (p. 301). In Waksman's opinion, introduction of antagonistic organisms is not likely to be successful without simultaneous adjustment of soil conditions to favor the controlling agent rather than the parasite.

Designed as a college text the book is well suited to that purpose. It is a compact and attractive vol-

ume. Its availability offers an excellent opportunity to every silviculturist to obtain a deeper insight into the processes of forest growth. The book is of special interest to foresters employed in nursery practice, a branch of plant production which is constantly concerned with either suppression or encouragement of different groups of soil organisms.

S. A. WILDE,
*Soils Department,*
*University of Wisconsin.*

### A Study of Forest Taxation in the Pacific Northwest.

By Julian E. Rothery. 47 pp. Industrial Forestry Association M, Portland, Oreg. 1952. $5.

The approach of the writer and the publishers to the analysis of forest taxation is both refreshing and commendable. No post mortem laments are made for a dead or dying industry. No frantic search is being made for a miraculous cure of a dangerously ill giant. Instead a giant-sized industry is carefully examined with the thought of keeping it healthy; and its continued health is of tremendous importance to the entire economy of the region.

This examination, by an expert, discloses a lack of pattern—a lack of common sense — in the assessment practices which determine the amount of taxes paid on timber and forest lands.

In times less prosperous than these, the weaknesses disclosed might easily be the Achilles' heel which would seriously cripple this giant which supports the 2,500 wood-using plants and their almost one quarter million workers. The spectre of liquidation of timber assets because of unrealistic taxes is not flaunted in the reader's face, but its possibility is in the background for those with common sense to see. And those who have seen the stump forests of other regions are fully aware of the tragic havoc that might be wrought.

In a tolerant and constructive way the writer examines and documents practices being used which result in inequalities of assessments and in unrealistic valuation of major and minor species.

A chapter is devoted to value and sound valuation practices. Pointed out is the fallacy of ignoring the interim operating and the nonoperating costs such as taxes, and the inherent risk of the enterprise in determining present value of timber which will be harvested or sold at some future date. The use of discount in determining such value is ably discussed and examples of its application are given. Bureau of Revenue findings and the Supreme Court decision in a timber case involving present worth of future income are used to illustrate the principle of discount.

Other tax problems inherent to forestry such as the valuation of immature timber, merchantable second-growth stands, and the use of staggered settings in harvesting are analyzed.

With understanding and restraint the author not only points out the problems but gives many of the reasons for their being.

There is the feeling ever present that here is a giant, now in good health, but seeking cooperation for fairer treatment in order that he may continue to be strong.

Tax assessors, businessmen, foresters, valuation students, and state officials should find this publication well worth their serious study.

ERNEST J. RUSSELL.
LLOYD P. BLACKWELL.

### The Lady and the Lumberjack.

By Olive Barber. 250 pp. Thomas Y. Crowell Company, New York 16. 1952. $3.

This book tells "the facts of life about loggers" from a woman's viewpoint, says Stewart Holbrook in his introduction. Mrs. Barber has undoubtedly accomplished this, but it is to be regretted that she did not learn as much of the facts about logging and forestry as she did about loggers, for the casual reader will also accept all her statements in these fields as gospel truth. Unfortunately, some misstatements and discrepancies are present.

Woods and logging camps became of prime importance to Mrs. Barber when, a young school teacher, she met and married a logger. Although a few other wives were also living in their first camp, the adjustment was a difficult one for a minister's daughter to make. The loggers' speech was apt to contain many adjectives she had been taught were sinful. Even without the obscenity, logging jargon was a foreign language not to be understood without much explanation. It was impossible to keep dampness out of clothes or beds while spending a winter in a tent in the Oregon woods. And did you ever try to find privacy inside a lighted tent?

Mrs. Barber did manage to adapt herself to camp life, logging talk, and loggers' ways. Her friendships with other wives were sincere and lasting. Yet she leaves the reader with the feeling that she did not ever quite relax and enjoy the life. Perhaps, as she says, her early training was too different and could not be completely overcome. This may have increased her ability to observe the life about her, but the eye through which she looked was always critical.

Regardless of this attitude, *The Lady and the Lumberjack* is a readable and entertaining account of logging camp life as experienced by Olive Barber. Many of the loggers, including her husband, were apt to get "wet noses" on a Saturday night. The results were far from quiet. One Saturday night was too much for Mrs. Barber, so she packed a bag and left.

But life wasn't that simple. When she began defending loggers and their ways on a radio program she was writing, she packed her bag again and returned to the woods. That, in spite of any drawbacks, was to be her life.

This book will make people feel that they've had an intimate glimpse into a strange new world of big men, big trees, big machines,

and big talk. Such a story could happen only in the woods of the Pacific Northwest; it will be a revelation to folks who take their two by fours for granted along with bottled milk.

RUTH HAGENSTEIN,
*Portland, Oregon.*

**Forests For the Future: The Diaries of David T. Mason.**

Edited by Rodney C. Loehr. 283 pp. Illus. Forest Products History Foundation of the Minnesota Historical Society, St. Paul 1, Minn. 1952. $3.50.

Here are off-the-cuff experiences and observations of a woods-going forester on many active fronts in a dynamic period. They cover an astonishing variety of contacts and activities. Mason began with national forest administration, in the saddle; moved up to regional timber management; taught forestry at the University of California; and, in World War I, was in the thick of military timber-cutting in the French Landes. His diary fails, however, to record an entertaining chapter in the history of the 20th Engineers, when a Portuguese schooner, laden with casks of Port and Madeira, was wrecked off the southern coast of France almost within sight of American logging camps.

After the war, Mason had the unique task of setting up base timber valuations and organizing methods of computation for forest industries under the new federal income tax law. In 1920 he became one of the pioneer consultants on forest management and industrial policy. Mason was well prepared for this undertaking by his wide acquaintance with the financial structure of lumber and paper enterprises. He had many opportunities to go to the heart of the basic instability of forest industries through lack of capital, overproduction, and the creed of quick liquidation of resources rather than their operation for the long pull. He attacked these problems in the front offices.

Mason's greatest service to American forestry has been his role of industrial diagnostician and his ability to prescribe basic remedies at the source of things. He has started many business men on long-range forest thinking and planning. His consulting firm at Portland, Oreg., has been joined, from time to time, by Carl Stevens, Donald Bruce, and James Girard.

In the early twenties, Mason organized one of the first regional industrial forestry programs in the United States among manufacturers of California redwood. His wide-ranging experience was extended further by several years as manager of the Western Pine Association; by the tough job of administering the Blue Eagle Lumber Code; and by active participation in framing and obtaining the enactment of important federal legislation on forestry.

Jim Girard used to say that "Dave Mason has been working for *sustained yield* since he was knee-high to a Kansas grasshopper." Certainly one of Mason's accomplishments has been the inoculation of industrial managers and foresters alike with the conception of sustained yield as a business principle which should not be relegated to the distant future but *put to work right now*. He preached sustained yield in the postwar depression of 1920, as the cure for overproduction when the lumber industry was struggling through recurring periods of cut-throat competition. He prescribed this cure for an unstable industry persistently, year after year, to forest owners, bankers, federal administrators, chambers of commerce, regional planning groups. He advocated the use of federal forests and the purchase of additional units carefully planned as centers of sustained-yield management in cooperation with private lands around them. These ideas were brought to a head in the report to President Hoover's Timber Conservation Board in 1932. (Incidentally, Mason had sold the idea to Secretary of Commerce Hoover in 1927.) The report of the Hoover Board carried the seed of the cooperative sustained yield laws of 1937 and 1944.

In 1934, Mason was drafted for service on the hottest spot in the lumber industry, the administration of the ill-starred Lumber Code under N.R.A. He lived through its strains and frustrations; then took active leadership in uniting the disillusioned industry to hold its one constructive gain from the whole code experience. This was concerted action in forestry under Code Article X. Mason realized that the industry "had the ball" in the conservation game and should keep it by forthright action of their own. This required not only the continuation voluntarily of forest practices started under government sanctions. It called also for following through on the proposals for legislation which had come out of code conferences by industry and government men.

Back in private life as forest engineer and consultant, Mason took an active part in formulating and enacting the law of 1937 which laid the basis for sustained-yield administration of the Revested O and C Lands in Oregon. Later on he devoted much time to perfecting the details and building up support for the general sustained-yield act of 1944, applying to all federal forest lands. His cardinal principle of cooperation in the management of adjacent public and private woodlands was incorporated in both measures.

Meantime and down to the present day, Mason's consulting and managerial activities have spread sustained yield conceptions widely among private forest operations, including the hill lands in Oregon which were placed under his personal direction.

Frank, pithy extracts from the diaries of this active forester crowd the pages of *Forests for the Future* like fast, short movies of current events on the screen. The "voice" which fills the interludes and carries the story from chapter to chapter is the discerning pen of Editor Rodney Loehr. Like that of any man who never dodges an issue or a situation, Mason's experience has

had its share of dead ends and frustrations. But the continuity which gives purpose and direction to the 43 years is the man's sheer persistence. Day after day, year after year, the cryptic symbol, "*s.y.*" marks some report, discussion, or proposal—a move somewhere to further forest management. Stopped on one approach, Mason found another. He has been a veritable Fuller brush salesman, greeting every open door with a smiling "Good morning, can I sell you sustained yield?"

*Forests for the Future* underscores several passages in Dr. Gulick's *American Forestry Policy*, passages which stress the influence upon national policy of the profession itself. Mason is one of the many trained men who have foreseen and engineered the American forestry of today. It was not solely because of a favoring economic climate that industrial woodland management has progressed so decisively since the last war. It is also the fruit of many patient years of work by the foresters of this country.

WILLIAM B. GREELEY.

**The Sage Grouse in Wyoming.**

By Robert L. Patterson. 341 pp. Illus. Sage Books, Inc. Denver 20, Colo. 1952. $5.

Before saying anything about the text of *The Sage Grouse in Wyoming*, the reviewer wishes to commend the author and the publisher for turning out a fine book. The plan, with a single exception noted beyond, is unusually good. The four main sections of the book, which deal with environment, natural history, relationships to man, and management, are likewise well organized. The text is beautifully printed on soft paper and of a type size easy to read; the binding is durable and attractive. The 54 tables and 18 figures reflect the author's successful effort to condense a great volume of data, a feature that helps to give the book a scientific permanency equal to its mechanical perfection.

Some years before his death Aldo Leopold observed that no comprehensive study of a distinctively western bird had ever been made, and that such a study ". . . might leaven the future of wildlife conservation in the whole western region." In the foreword, Lester Bagley, Wyoming Game and Fish Commissioner, wrote: "It is modestly but confidently hoped that, with the publication of this . . . monograph the omission cited by the late Dr. Leopold has found remedy."

There is no doubt that the first of these two ponderables has been achieved. In volume and detail, *The Sage Grouse in Wyoming* does not equal Stoddard's, *The Bobwhite Quail* or even approach Bump *et al.* in *The Ruffed Grouse*, but it suffers no disparagement as a "comprehensive study" through its lesser bulk and page content. The reviewer has found it easier to use than either of the two monumental works listed. Obviously, it is and was intended to be, less inclusive than either in detail. Only time will tell whether the Sage-grouse book will achieve Leopold's conditioned prophesy, although the reviewer suggests that it should serve as a model for species studies, in the West and elsewhere, for a long time to come.

Part I, The Sage Grouse and its Environment, is largely an historical account, with emphasis on range and distribution. Taxonomy is restricted to two pages. There is a good summary of sage grouse investigations. Of the Upper Green River Basin, the locale of the present investigation, the author gives a detailed description of the physical, plant, and animal environments, including the role of water on sage grouse abundance. The discussions on sagebrush development, disease and other hazards, and the influence of the sage grouse on the plant and animal components of the environment are informative and temperately presented.

The Natural History of Sage Grouse Populations (Part II) consists of two sections: Inventory and Census Methods and Natural History. The arrangement seems somewhat incongruous until it is realized that it is here that the author describes the numerous field methods, all intimately associated with sage-grouse biology and behavior, used in determining the life history of the species. This life-history study is complete, and includes sections on nesting, young, breeding, adaptive features, behavior patterns, tolerances, and food and water requirements. There is no comparable account for the sage grouse in the literature.

In Part III, Sage Grouse and Man, Dr. Patterson discusses Wyoming's extensive trapping and transplanting p r o g r a m, recent hunting seasons, and grouse populations in relation to land-use. In Part IV, the two main sections are, A History of Sage Grouse Restoration and A Plan for Sage Grouse Management. It appears to the reviewer that the section on trapping and transplanting is so closely associated with restoration and management that they could well have been put together. The author's method of handling subject matter, however, does not lessen the book's utility, especially when it is found that, as is true of all others, this subject is handled with characteristic thoroughness and skill.

The illustrations deserve special attention. A total of 97 generally excellent black-and-white photos—a vast number for a commercial book—and numerous decorative sketches, or vignettes, distinguish it both from the illustrative and artistic standpoints. The drawings are by Charles W. Schwartz, and are done in fine ecological setting by this outstanding artist-photographer-biologist. Most of the photographs are by the author. Some readers might object to the repetition in illustrations—for example, the ten or more photographs of grouse nests. To the reviewer, these, and other, admittedly similar shots show differences in cover-use, range, behavior, and other phenomena, and their inclusion adds to the completeness of the work.

The foregoing sketch of subjects

is but the briefest summary of the books's content. Good diction, less wordage and repetition than in some scientific treatises, and a pleasing literary style for non-popular writing, are, in addition to its basic soundness, the criteria on which *The Sage Grouse in Wyoming* seems destined to win, and hold, a high place in wildlife literature.

The Wyoming Fish and Game Commission, the instigator of this work, deserves the thanks of the wildlife profession for its support of the field project and for making available the results. It should be acknowledged, also, that the investigation was financed through the Federal Aid to Wildlife Restoration Act (Pittman-Robertson), and serves as a special and distinguished example of what may be accomplished with talent, a resource, objective purposes, and money, cooperatively expended.

LEE E. YEAGER.

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**Paul Bunyan: Last of the Frontier Demigods.**

By Daniel G. Hoffman. 213 pp. Illus. University of Pennsylvania Press, Philadelphia. 1952. $4.50.

In his translator's note to *The Odyssey of Homer*, the late great T. E. Shaw (Lawrence of Arabia) explained how he "tried to deduce the author from his self-betrayal in the work. I found a bookworm," he wrote, "no longer young, living from home, a mainlander, city-bred and domestic . . . very bookish, this house-bred man. His work smells of the literary coterie, of a writing tradition." I don't know why this description leaped to my mind on reading Prof. Hoffman's book.

It is a scholarly work. The author's standing in erudite circles, together with the distinction of the publishing house, assures the literary qualities of the book. In addition, it is a handsome volume typographically, and excellently written.

A key to the author's approach to this fascinating subject may be found in the following apt quotation:

"In the United States, the age-long process by which a national mythology is formed was necessarily foreshortened into a few generations. The tribe of comic demigods of whom Paul Bunyan is the last are our equivalents to the heroes not of epics but of anecdotes; no bard or scop had time to complete an epic based on native myths before the relentless march of history overwhelmed the folk cultures of the American frontier."

All readers of this review know who Paul Bunyan is. So let us identify the author. Prof. Hoffman is an instructor in American literature at Columbia University, who has also taught at Rutgers and Temple University. Moreover, he is a councillor of the American Folklore Society.

Not everyone who has ever chuckled over a Paul Bunyan tale, who has delighted in the humor and gusto of this most typical of American folk-heroes, will find entertainment in Prof. Hoffman's book. For it is not another collection of Paul Bunyan stories; it is a book of literary criticism.

In his later years Somerset Maugham once said, "I still read a great deal of criticism, for I think it a very agreeable form of literary composition." Prof. Hoffman's book is in that tradition—a very agreeable form of literary criticism. I like it.

But even while I like it, I ask myself, "Why must professors dealing with such a subject as folklore, which by its very nature is usually comic and exaggerated with a wry sense of the ridiculous, be so deadly serious and partisan?" Folklore is founded on oral legend, and if the legend is built on by those imaginative enough to add to it, when does it cease to be folklore?

These rhetorical questions are prompted by Prof. Hoffman's annoyance with James Stevens who wrote one of the earliest and most successful Paul Bunyan books. Prof. Hoffman calls it a bad book, and devotes twenty pages and copious notes to prove it. All the same, Prof. Hoffman is wrong. Jim Stevens' book is not a bad book. It simply does not conform to Prof. Hoffman's pattern of a folktale.

Jim invented most of his Paul Bunyan stories and told them so well that they had the authentic ring of original folktales. Well, perhaps they don't ring true to a councillor of folklore society, but when they first appeared in the old *American Mercury* in the early 1920's their publication was an exciting literary event, I remember.

I wish, though, Prof. Hoffman hadn't said one thing about Jim's stories. It's the unkindest cut of all. "As literature," he writes, "they are for the most part painfully puerile, absurdly over-written, and dramatically vapid." At this point I interrupted my reading of Prof. Hoffman's book to refresh my memory of Jim's. I admit I could be mistaken about what is literature and what is not. But the eminent critic, Laurence Stallings, called Stevens' *Paul Bunyan* "the magnificent history of the North Woods hero, done into permanent literary form at last." Can anyone read Jim's description of the falling of the blue snow in the story of that name and not recognize it as literature? Prose poetry is what it is.

Yes, Prof. Hoffman is pretty hard on old Jim. He calls Jim a popularizer, and claims Paul (Jim's Paul, that is) "has no moral standards." He says Jim wrote "values into the lumbering life which do not appear in the woods." Although old Jim's been hanging around logging camps for forty years, I reckon if an instructor of literature at Columbia University, which is practically right in the heart of the tall timber, or at least close by, says this about Jim, it must be so. He says Jim errs in other ways too—"he repeats the lumberjacks' tales with grander flourishes than they could imagine." Well, why not? Jim's a pretty smart man; he can read, write, and cipher; so why shouldn't he add flourishes to tales that were

probably varied in each telling and constantly altered as they were carried about the country in a migratory industry? There's no canon of the tales that I know of.

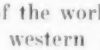
But Prof. Hoffman adds a clincher, and I don't see how Jim can survive it. "In his theoretical prolegomena he confuses his readers on every point discussed."

To me this seems extra rough on old Jim who just possibly, unknown to the councillor, might have created folklore himself. I'd go so far as to venture the opinion that old Jim's "The Frozen Logger" may in time become a folksong, which in some future era as yet-unborn Alan Lomax may induce a latter-day Burl Ives to record for the folklorists of 2053.

I wish Prof. Hoffman had directed his indignation at the purveyors of advertising copy who have exploited Paul to sell canned peas, kitchen appliances, and dipping snuff, rather than at old Jim. For if Prof. Hoffman could just once hear old Jim sing "The Frozen Logger" in his unmusically pleasant voice with the shy, engaging gestures, he would take back all the harsh words he's written. I bet. Meanwhile, poor old Jim, who probably hasn't more than a dozen or so best-sellers left in him, will have to find other subjects to write about.

So, stand aside, Jim, the college professors have taken over.

HENRY CLEPPER.



**Insect Enemies of Western Forests.**

By F. P. Keen. 280 pp. Misc. Publ. 273, U. S. Dept. Agriculture. U. S. Govt. Printing Office, Washington 25, D. C. 1952. $1.

It is axiomatic that forest protection must have first place in any adequate forestry program. For a long time forest protection largely meant fire protection, but the tremendous losses by insects and diseases during the past two decades are being more fully recognized now. Successful aerial forest spraying of millions of acres for the control of defoliators, effective large-scale control work against such insects as the spruce beetle in Engelmann spruce, the mountain pine beetle in lodgepole pine, and the western pine beetle in ponderosa pine, has given new courage to private, state, and federal forest managers in the West. No one is better qualified to write on these western problems than Paul Keen of the federal Bureau of Entomology and Plant Quarantine who has had more than 35 years of experience in western United States in the fields of research, insect surveys, control projects, and in the development of cutting practices designed to reduce the likelihood of destructive insect outbreaks.

This publication is a thorough revision of earlier editions of the same title by the same author. These early editions were soon exhausted, so great was the demand from foresters, timber owners, and protection agencies. The reviewer predicts the same popularity for this edition for it retains the same simple and direct approach of the early editions and has many improvements.

It is the skillful organization of the material as well as its substance that makes this manual so effective for use by those who have little knowledge in forest insect protection as well as by the professional forest entomologist. The author is both a forester and an entomologist by training and experience. Keen has always recognized the importance of the work of such pioneers in the western field as Hopkins, Beal, Burke, Craighead, Evenden, Furniss, Hopping, Miller, Patterson, and others, but to Keen himself is due much credit for bringing about a wider understanding of western forest insect problems. His 1952 edition of *Insect Enemies of Western Forests* will focus further attention on the difficult and large forest insect problems which plague forest protection west of the Great Plains.

Besides the usual citation of literature and a general index, there is an unusual index which will help the forester to identify pests in the field. It is called an "Index of Host Trees." For each tree species the insects are divided into such categories as those attacking needles, those in cones or seeds, those in smaller limbs, twigs or trunk, and finally those insects working in wood. This index covers 17 pages of fine print and adds immeasurably to the usefulness of the manual.

The publication begins with a statement of the significance and character of forest insect losses. Then follows a detailed discussion of the injurious insects under the following five categories: forest nurseries; young trees (seedlings, saplings and poles); mature forest trees; wood and other forest products; and forest range plants. The manual ends with a brief section on natural control; and finally a section on silvicultural, biological, and artificial control.

A few minor errors and omissions have crept into the publication which can be easily corrected in the next edition. The author will have to re-state the role of the Douglas-fir beetle (*Dendroctonus pseudotsugae*) in the Pacific Coast region if he undertakes another revision. At the present writing (December 1952) more than one billion board feet of standing Douglas-fir in western Oregon and Washington are infested by this tree-killer so well known in the Rocky Mountain region. In addition, nine billion board feet of windthrown Douglas-fir in the Pacific Northwest carry a tremendous number of beetles which will emerge in the late spring of 1953 to attack and kill nearby Douglas-fir. Salvage of beetle-infested material is the only answer since direct control measures are not feasible.

Probably more than 90 percent of the forest insect damage in western United States is due to the activity of less than 20 species of forest insects. The reviewer believes that a manual such as Keen's could be strengthened by listing these insects in the introductory statements. It would tend to focus attention of the forest manager to those insects which are of the greatest significance from among

the hundreds of insects included in the publication. It is recognized that it takes courage to prepare such a list that will stand the test of even a decade. In 1947 who would have dreamed that it would be necesary to spray three million acres of forest in Oregon and Washington during the four year period 1949-1952 to protect Douglas-fir and white fir from the ravages of the spruce budworm? Or who would have predicted in 1950 that the Douglas-fir beetle would be responsible for the killing of more than a bilion board feet in the Pacific Northwest in 1951 and 1952 and threatens to kill much more in 1953?

Attention should be drawn to *Insect Enemies of Eastern Forests* by F. C. Craighead, formerly of the Division of Forest Insect Investigations of the federal Bureau of Entomology and Plant Quarantine. This 680-page publication covers the forest insect situation in the United States east of the Great Plains. It appeared in 1950 as Miscellaneous Publication 657 of the U. S. Department of Agriculture. It can be secured from the Superintendent of Documents, Washington 5, D. C., for $2.50.

A. J. JAENICKE,
*U. S. Forest Service.*

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**Resource Conservation: Economics and Policies.**

By S. V. Ciriacy-Wantrup. 395 pp. University of California Press, Berkeley. 1952. $6.50.

Here is a new approach to conservation, one that should be given careful study by all those recognizing the important place of natural resources in our economy. By a masterful presentation the author carries the reader through a complete analysis of resource conservation which will be valuable to many groups with varying backgrounds and interests.

The book neither includes a history of conservation nor methods of conservation practice. Emphasis is placed on an analysis of economic and institutional forces affecting conservation decisions and principles applicable to policy implementation. Too often in the past economic and social aspects of conservation have been neglected. It is the author's conviction that depletion of natural resources often results through these economic influences, not because of a lack of interest or knowledge of conservation technology. If necessary conservation practices do not pay, conditions can be rectified, for often the reasons are man-made.

In presenting his study, S. V. Ciriacy-Wantrup, professor of agricultural economics at the University of California, contends that recent changes of technology, population growth, and social institutions have created a demand for economic analysis of resource use. He explains that the problem of accelerated depletion of natural resources results ultimately in adverse effects on our economy which cannot be solved without a firm economic and political foundation for conservation.

Disagreeing with the approach and many of the remedies proposed by recent pessimistic literature on conservation, the author develops an all-inclusive definition of conservation suitable for quantitative economic analysis. "Wise use" and "greatest use to the greatest number in the long run" have little meaning and are of no value under such conditions. Instead, conservation is defined "as changes in the time distribution of use rates of individual resources in which the aggregate weighted change in use rates is greater than zero." The reader need not be alarmed, for in developing this definition all terms are clearly defined.

With this as a starting point, the behavior of private resource users with respect to conservation is considered and the optimum state of conservation in private economies, an analysis of which forms the main core of the study.

In a clear and succinct presentation, the author shows why the following factors all tend to discourage conservation: higher interest rates; lower incomes; fixed charges; greater uncertainty about future costs and prices; an outlook for long-term lower product prices; price supports; insecure tenure; heavy indebtedness; property taxes; and wavering public conservation policy. In contrast, conservation is encouraged by lower interest rates; better markets for assets; sound crop-insurance programs; an outlook for long-term higher product prices; flexible amortization and interest payments; income and yield taxes instead of property taxes; installment payments of estate and inheritance taxes; education; zoning; subsidies for conservation practices when the public receives some of the benefits; and steadiness of public conservation policy.

On the basis of the analysis of economic forces as affecting conservation in private economies, the author then turns his attention to the social economics of conservation. Although the social optimum state of conservation is theoretically one in which social net revenues are minimized over time, definition has limited practical use. Therefore, a "safe minimum standard" realized with minimum total social costs is recommended as the first objective of social conservation policy. This dictates that "the land must be restored to such an extent that under presently foreseeable economic conditions resumption of the previous use at some level at some future date is not impossible."

The remainder of the book is devoted to implementation of conservation policy. Particular emphasis is placed on the direct tools including education, zoning, and regulation, since indirect tools of conservation policy were included in the previous discussion of economic and institutional forces; such as taxation, tenure, and credit. It is concluded that direct interference with private enterprise is both socially and legally risky in conservation policy if used for objectives righer than a safe minimum standard. However, due to uncertainty of indirect tools, zoning and regulation are especially effective

in attaining such a standard with minimum interference to private enterprise, since this would entail a state of conservation usually below the private optimum.

International tools of conservation policy are discussed; including international conferences, treaties (conventions), permanent international agencies, and international commodity agreements. The last chapter considers ways in which conservation activities can be coordinated among various agencies.

Throughout the book concrete examples taken from agriculture, forestry, fishing, mining, and oil drilling are used to illustrate the author's findings. This, together with the method of presentation, increases the breadth of value. Although there are numerous sections dealing with economic theory particularly valuable to the professional economist, the author invites other readers to skip such sections. This in no way detracts from the overall theme that is presented. It is not a story of man's past abuse of soil, forests, or grasslands, but a thoughtful analysis of present economic forces as they relate to natural resources vital to the successful future of our democratic, free-enterprise society.

EUGENE V. ZUMWALT,
*Yale School of Forestry.*

### Planning One Town: Petersham, A Hill Town in Massachusetts

By John D. Black and Ayers Brinser, 75 pp. Illus. Harvard University Press, Cambridge, Mass. 1952. $1.25.

Foresters concerned with the social and economic problems of sparsely populated forested hill towns such as we have in New England should place this book on their required reading list. There are five chapters: The town and its problems; agricultural possibilities; woodland possibilities; industrial, recreational, and residential possibilities; and . . . governmental aspects. Like all New England hill towns, Petersham's agriculture has retarded during the last ten decades to limited areas of good soil. There is an opportunity of expanding the dairy business on many of the remaining farms in the town, if careful planning is done by the owners. The importance of a combination of dairy and forest farming is stressed as a means for the farmer to make full use of his labor and soil resources. The question is raised about developing new farms in Petersham. The authors offer what they term an obvious answer which is that the world is not short enough of food to warrant it.

There are those who will question such a conclusion. This statement of fact about Petersham's agricultural possibilities in relation to the world food supplies centers attention on developing the forest resources of Petersham's 17,489 acres of woodland. The subject is discussed in detail. A careful analysis on 1,900 acres of woodland in the town is the basis for projecting the per-acre annual income of the woodlands up to the year 2040. Different amounts of per-acre annual income are presented, depending upon the degree of intensity of forest management practiced.

The authors are realistic in stating at the close of the discussions on agriculture and forestry opportunities that the largest factor in the gap between possibilities and realities is the attitude of the people. In considering the government aspect for the town of Petersham they observe that the real estate tax base from which the town's people can raise and appropriate money for schools, roads, and other public needs is largely limited to the continued annual earnings obtained from the soil in the form of food and fiber. Anyone living in a New England small town and affiliated with town affairs quickly learns that there are three general possibilities to consider in a plan to keep real estate taxes from becoming confiscatory; abolish the town as a political unit, continue the present town organization with extremely limited services, and organize some of the public services on an inter-town basis. The authors have clearly presented the raw material out of which to fashion a development program by the citizens of Petersham.

K. E. BARRACLOUGH.

### Publications of Interest

THE DIVISION of Forestry Relations of the Tennessee Valley Authority announces that its *Annual Report for 1952* is now available to interested persons. Copies may be obtained from Willis M. Baker, Director of Division of Forestry Relations, Norris, Tenn.

* * *

THE SOUTHERN Regional Education Board has issued a report of the conference on the regional program in forestry education and research held in Atlanta, Ga. last October.

This conference, which brought together 40 representatives of industry, government, business, and educational institutions, was called by the Board to define the critical problems in forestry education and research in the South, and to recommend solutions.

As an indication of the importance attached to this subject, the conference was attended by two governors, three university presidents, a bank president, and high officials of several forest products industries, as well as by leaders in professional forestry education in the South.

Copies of the report may be obtained from the Southern Regional Education Board, 830 West Peachtree Street, N. W., Atlanta, Ga.

* * *

A CATALOG of supplies and equipment used in tree surgery, landscaping, and nurseries, and which includes chain saw distributors and generators, has recently been published by the Arborist Supply Company, Inc., 12 Smith Street, Rye, New York. The catalog, which will be sent free on request is dated December 20, 1952.

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THE CONSERVATION Foundation, 30 East 40th Street, New York City, has published a study summarizing varying interpretations of significant facts and figures relating to forest resources, entitled *Forests for the Future.* The report, originally published as a supplement to the December 1952 issue of *American Forests,* may be obtained separately from the foundation, 30 East 40th Street, New York City.

# Current Literature

*Compiled by* MARTHA MEELIG, *Librarian, The New York State College of Forestry*

*Range Management Section Compiled by* FRANCES FLICK, *Library, U. S. Department of Agriculture*

### General

*American Forest Policy; A Study of Government Administration and Economic Control.* By L. H. Gulick. 252 pp. Duell, Sloan and Pearce, New York. 1951. $3.00.

*Christmas Trees, the Tradition and Trade.* By A. M. Sowder. 22 pp. Illus. U. S. Dept. of Agric. Forest Serv., Washington 25, D. C. 1952. Agric. Info. Bul. No. 94. 10 cents (Govt. Print. Off.)

*Green Treasury; A Journey Through the World's Great Nature Writing.* Ed. by E. W. Teale. 600 pp. Illus. Dodd, Mead, New York. 1952. $5.00.

*A Guide to the Hitchiti Forest Research Center.* By E. V. Brender. 26 pp. Illus. Southeastern Forest Expt. Sta., Asheville, N. C. 1952. Sta. Paper No. 19.

*The Lumberyard and Mrs. Barrie.* By Jane Barrie. Illus. Henry Holt, New York 17. 1952. $3.00.

*To Know the Trees; Important Trees of the United States.* By E. L. Little, Jr. p. 763-814. Illus. 1952. Reprint from Yearbook of Agric. 1949. U. S. Dept. of Agric., Washington, D. C.

*Trees and Shrubs in Eastern North America.* By Benamin Blackburn. 358 pp. Illus. Oxford Univ. Press, New York 11. 1952. $6.00.

*United States Tree Books; A Bibliography of Tree Identification.* By W. A. Dayton. 32 pp. U. S. Dept. of Agric., Washington, D. C. 1952. Bibliographical Bul. No. 20. 15 cents (Govt. Print. Off.)

### Farm Forestry

*Managing Southern Piedmont Farm Woodlands Pays Dividends.* By T. A. McClay. 8 pp. Southeastern Forest Expt. Sta., Asheville, N. C. 1952.

### Forest Resources

*Forest Statistics for Cowlitz County, Washington.* By F. L. Moravets. 24 pp. Maps. Pacific Northwest Forest and Range Expt. Sta., Portland, Ore. 1952. Forest Survey Report No. 105.

*Forest Statistics for Tennessee.* 56 pp. Southern Forest Expt. Sta., New Orleans, La. 1952. Forest Surv. Release No. 70.

*Forest Statistics for Wahkiakum County, Washington.* By F. L. Moravets. 23 pp. Maps. Pacific Northwest Forest and Range Expt. Sta., Portland, Ore. 1952. Forest Surv. Report No. 106.

### Forest Management

*Nipigon Growth and Yield Survey.* Project H-69. By G. H. D. Bedell and D. W. MacLean. 51 pp. Canada Dept. of Resources and Devel., Ottawa. 1952. Silv. Research Note No. 101.

*Volume Tables for Small-Diameter Loblolly and Shortleaf Pine Trees.* By S. M. Potts. 22 pp. TVA Div. of For. Relations, Norris, Tenn. 1952. Tech. Note No. 10. Mimeog.

### Protection

*Control of the Yellow-Headed Spruce Sawfly in the Agricultural Areas of the Prairie Provinces.* By L. O. T. Peterson. 3 pp. Canada Dept. of Agric., Sci. Serv., Div. of Ent., Ottawa. 1950. Proc. Publ. Serv. No. 120.

*Insect Enemies of Western Forests.* By F. P. Keen. 280 pp. Illus. U. S. Dept. of Agric., Washington, D. C. 1952, rev. Misc. Publ. No. 273. $1.00.

*Forest Fire Control Tennessee Valley Counties of Alabama 1947-1952.* 12 pp. Alabama Dept. of Conservation, Div. of For., Montgomery. 1952.

*Protecting Wisconsin's White Pine from Blister Rust.* 6 pp. Map. Wis. Dept. of Agric., Madison 2. 1952. Spec. Bul. No. 10.

### Range Management

*Blood Serum Protein Content of Mature Range Ewes as Influenced by Level of Protein in Their Ration.* By F. Whiting and Others. Scientific Agriculture, Ottawa, Canada. Vol. 32, pp. 421-426. August 1952.

*Chamiza for Reseeding New Mexico Range Lands.* By H. W. Springfield and R. M. Housley. 5 pp. U. S. Forest Serv., Southwestern Forest & Range Expt. Sta., Tucson, Ariz. Research Note No. 122. October 1952. Mimeog.

*The Forage Crop Resources of the Eastern Region of South America, from Buenos Aires to São Paulo.* By W. Williams. British Agric. Bul., British Council, London. No. 5, pp. 112-116. Illus. July 1952. 60 cents.

*Life on the Texas Range.* Photographs by E. E. Smith. Text by J. E. Haley. 112 pp. Illus. Univ. of Texas Press, Austin. 1952. $10.00.

*Evolutionary Role of Grazing Animals in the Species Formation of Angiospermous Plants.* (In Russian.) By O. I. Morozova. Botanicheskii Zhurnal, Moscow, U.S.S.R. Vol. 37, pp. 158-172. 1952.

### Recreation

*Forest Camping in Oregon; Directory of National Forest Camps.* 68 pp. U. S. Forest Serv., Pacific Northwest Region. 1952. Mimeog.

*Forest Camping in Washington; Directory of National Forest Camps.* 50 pp. U. S. Forest Serv., Pacific Northwest Region. 1952. Mimeog.

### Silviculture

*American Silviculture and Tropical Forest Problems.* By O.E.E.C. 95 pp. Columbia Univ. Press, New York 27. 1952. $1.25.

*A Directory of Forest Genetics Research in the United States and Canada.* By J. W. Wright. Northeastern Forest Expt. Sta., Upper Darby, Pa. 1952. Sta. Paper No. 53. Mimeog.

*1952 Report on Forest Tree Breeding in Sweden and Other European Countries.* By R. G. Hitt. 88 pp. Illus. Univ. of Wisconsin, Madison. 1952.

*Poplars.* By T. R. Peace. 50 pp. Illus. Great Britain Forestry Comm., London. 1952. Bul. No. 19. 7s.6d. (H. M. Sta. Off.)

*A Preliminary Study of Growth and Development of Some Douglas Fir-Ponderosa Pine Types.* By M. B. Clark. 39 pp. British Columbia Forest Serv., Victoria. 1952. Tech. Publ. No. 38. 25 cents.

*Re-establishing Pine on Piedmont Cut-over Land.* By E. V. Brender and T. C. Nelson. 8 pp. Illus. Southeastern Forest Expt. Sta., Asheville, N. C. 1952. Sta. Paper No. 18. Mimeog.

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*An Aerial Moose Census.* By R. Y. Edwards. 9 pp. Map. British Columbia Forest Serv., Victoria. 1952. Research Notes No. 23.

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*Identification of Hardwoods, a Lens Key.* 120 pp. Illus. Great Britain Dept. of Sci. and Indus. Res., London. 1952. Forest Products Res. Bul. No. 25. 5s. (H. M. Sta. Off.)

*Textbook of Wood Technology.* Vol. 2. By H. P. Brown, A. J. Panshin and C. C. Forsaith. 783 pp. Illus. McGraw-Hill, New York 36. 1952. $10.00.

# Society Affairs

**Officers and Members of the Council, 1952-1953**

GEORGE L. DRAKE, *President*
Simpson Logging Company
Shelton, Wash.

WILLIAM J. BROWN
Woodlands Department
Kimberly-Clark Corporation
Neenah, Wis.

D. B. DEMERITT
Dead River Company
6 State Street
Bangor, Me.

FRANK H. KAUFERT
School of Forestry
University of Minnesota
St. Paul 1, Minn.

ELWOOD L. DEMMON, *Vice President*
Southeastern Forest Experiment Station, Federal Building
Asheville, N. C.

C. OTTO LINDH
U. S. Forest Service
P. O. Box 1310
Albuquerque, N. M.

GORDON D. MARCKWORTH
College of Forestry
University of Washington
Seattle 5, Wash.

RICHARD E. MCARDLE
Forest Service
U. S. Department of Agriculture
Washington 25, D. C.

HENRY CLEPPER, *Executive Secretary*
Mills Building, 17th Street at Pennsylvania Avenue, N. W.
Washington 6, D. C.

EARL PORTER
Southern Kraft Division
International Paper Company
Mobile 9, Ala.

PERRY A. THOMPSON
12 Elkin Court
San Rafael, Calif.

RUTHFORD H. WESTVELD
Department of Forestry
University of Missouri
Columbia, Mo.

## Report of Kentucky-Tennessee Section Meeting

Seventy members of the Kentucky-Tennessee Section met in Knoxville, Tenn. on December 5 and 6, 1952. The first day of the meeting was devoted to technical discussion and the second day to Section business. E. L. Demmon, S.A.F. vice president, gave a summary of the Montreal meeting.

New officers installed were Henry Sipe, chairman, Cumberland National Forest, Winchester, Ky., and Kenneth J. Seigworth, vice chairman, TVA Forestry Building, Norris, Tenn. John W. Lehman, secretary-treasurer, P. O. Box 88, Norris, Tenn. was elected to this office last year for a three-year term. Harry Nadler, retiring chairman, is the fourth member of the executive committee. Mr. Seigworth will serve as the Section's membership chairman.

The morning session was devoted to a discussion by consulting foresters doing business in the Section area. Morris Morgan of Athens discussed some of the problems in establishing and operating the consultant business. Charles Page of Chattanooga discussed responsibilities of the consulting forester in acquainting the general public with forestry problems and situations. He particularly stressed that the consultant's selling of forestry is essential if he intends to stay in business.

Harry Murphy of Southern Timber Management Service, Sheffield, Ala. described services that his company renders in providing a complete service to the landowner. This involves management, harvesting, processing, and marketing services. Stanley Green of Johnson City told about his using the Jackson Harvester to provide services to the small woodland owner. One encouraging result has been the number of repeat jobs that he has had.

Frank W. Woods of the University of Tennessee, who received the Junior Member Award, presented a paper entitled "Disease as a Factor in the Evolution of Forest Composition." The section presents a cash award annually to the Junior Member who submits the best technical report during the year.

The afternoon session was devoted to a discussion of the recent critical forest fire situation during October and November. For Kentucky, State Forester Newland told about the situation on private lands, and Harold Borden, supervisor of the Cumberland National Forest, described the steps taken to handle fires on the national forest.

For Tennessee, State Forester Carl Peterson told about the situation on private lands. William Paddock, supervisor of Cherokee National Forest, told about the situation in the upper east Tennessee area where one particularly bad fire occurred. He described generally how the fires were handled and what was done to bring the situation under control.

TVA foresters were hosts at a social hour preceding the banquet. Door prizes were contributed by local Knoxville firms.

JOHN W. LEHMAN,
*Secretary-Treasurer.*

## Report of Meeting of Northern California Section

A program aimed at strengthening forest research and application of technical knowledge was adopted by the Northern California Section at its 25th annual winter meeting in Oakland, November 29, 1952.

Recommendations approved by the members provide first for a Standing Committee on Forest Research to be established in the Section. This will serve as a clearing house for practicing foresters and research agencies and will be responsible for special studies undertaken by the Section.

The standing committee will operate through appropriate subcommittees. Four of these were recommended: on soils, aerial photography, forest regeneration, and cooperative research in management of young growth and cutover lands.

A third recommendation called for more educational work with forest land owners and timber operators and pledged the Section to assist the Small Woodlands Council in this field. The Council is an informal organization of public and private foresters sponsored by the University of California School of Forestry and Extension Service. It is concentrating on educational measures for small forest owners.

Three other topics were highlighted at the meeting: planting and seeding, management and use of high elevation true firs, and taxation of young growth and cutover lands.

The convention started with a panel led by Dean Frederick S. Baker of the

University of California School of Forestry. This group described recent developments in coping with seed-eating rodents, unfavorable weather and competing shrubs—the three main deterrents to reforestation on much of the two million acres of potential planting sites in the state. Speakers for research were H. A. Fowells, Forest Experiment Station; for pine operations, R. D. Roseberry, Diamond Match Co.; for redwood operations, A. H. Merrill, Hammond Lumber Co.; for national forests, C. W. Corson, U. S. Forest Service.

New problems to most California foresters—harvesting timber and manufacturing lumber from the white and red firs growing in high elevation forests—were discussed by a second morning panel. Members of this group were: moderator, John Zivnuska, University of California School of Forestry; appraisal and marking, R. P. McRorey, U. S. Forest Service; logging, H. C. Abraham, Foresthill Logging Co.; manufacture and sales, Carl Walker, Feather River Pine Mills Inc.

In the afternoon a third panel discussed the problems that have arisen as a result of recent proposals to tax young growth and cutover lands which, since 1926, have been exempt from taxation. This group was led by State Forester DeWitt Nelson; Walker Tilley, forester for Mesonite Corporation, described effects of taxation on the timber industry; John H. Keith, chief of the Division of Assessment Standards, State Board of Equalization, described difficulties in administering the present law; and Harold B. Elliott, Butte County assessor, told how his office and a committee of local timber operators are working out their solution to timber taxation problems.

Nominations for 1953-1954 section officers were presented: for chairman, John M. Buck and George Craig; for vice-chairman, John Callahan and Gordon Robinson; for secretary-treasurer, Norman Spangenberg and Kenneth Bradshaw. Benton Howard, chairman of the membership committee, reported that between 70 and 75 percent of the eligible foresters in Northern California were now members of the Section.

Some 250 members and guests attended the daytime sessions, and 180 members and ladies were present for the evening cocktail hour and banquet. Brutus Hamilton, director of intercollegiate athletics at the University of California, was guest speaker and chose as his topic an account of his experiences at the Olympic Games in Helsinki. George Craig of Sacramento was chairman of the program committee and W. R. Howden headed the group which cared for local arrangements.

CLYDE M. WALKER, *Chairman, Publicity Committee.*

## Necrology

December 1, 1951 — November 30, 1952

### Fellow

Girard, James W., Portland, Oregon.
Spring, S. N., Atlanta, Georgia.
Wilson, Ellwood, Knowlton, Quebec, Canada.

### Honorary

Clutterbuck, P. H., London, England.
Robinson, Lord Roy Lister, London, England.

### Member

Chase, Willis E., Grand Rapids, Michigan.
Durfee, Harold A., Seattle, Washington.
Gaiser, Richard N., Athens, Ohio.
Gheen, Russell Taylor, Los Angeles, California.
Hamilton, James W., Mayfield, Kentucky.
Krueger, Theodore, Denver, Colorado.
Marsh, S. H., Arlington, Virginia.
Mather, Deane W., Ocala, Florida.
McKinney, Clayton A., Carthage, North Carolina.
Miller, J. M., Palo Alto, California.
Orr, Samuel W., Idaho Springs, Colorado.
Penick, Norman J., Portland, Oregon.
Risch, Lucius J., Jr., Bogalusa, Louisiana.
Ross, Robert M., Tenants Harbor, Maine.
Soland, Orlo E., Duluth, Minnesota.
Wood, Arthur A., Elkins, West Virginia.

### Junior

Carlson, Thorwald A., Madison, Wisconsin.
Engen, Edward T., Berkeley, California.
Nelson, John H., Bemidji, Minnesota.
Pierce, Joseph L., Hattiesburg, Mississippi.

### Associate

Legett, Albert A., Jackson, Mississippi.

### Affiliate

Kern, L. E., Shoals, Indiana.

## Miriam Bomhard (1898-1952)

Dr. Miriam L. Bomhard, one of the leading American authorities on palms, died December 16, 1952 at Glenshaw, Pa. She was 54 years of age.

Born in Bellevue, Ky., July 24, 1898, she attended the University of Pittsburgh, receiving the B.S. degree in February 1921, the M.A. degree in June of that year; and in 1926 the Ph.D. degree. She was the first woman to be granted the doctorate in botany and zoology from that institution.

From 1921 to 1925, she was a graduate assistant and instructor in botany at the University of Pittsburgh. During the period 1926 to 1932 she was instructor and assistant professor of botany and biology at Newcomb College, the women's department of Tulane University, where she was the founder of the courses in biology.

Since 1924 Dr. Bomhard had worked for the Division of Range Research of the U.S. Forest Service in Washington, D. C., as botanist and associate ecologist. She had been on sick leave from the Service for nearly a year at the time of her death.

Dr. Bomhard was a member of numerous scientific organizations, among them the Washington Academy of Sciences, the Botanical Society of Washington, the Botanical Society of America, the American Society of Plant Taxonomists, and the Ecological Society of America. One of the founders of the Botanical Society of New Orleans, of which she was later president, she was also a Fellow of the American Association for the Advancement of Science, and has been an Associate Member of the Society of American Foresters since 1942.

Dr. Bomhard travelled throughout the world in her studies; she had served as a member of the 5th International Botanical Congress and as a delegate to the 8th American Scientific Congress. Well-trained in botany, zoology, and ecology, she contributed materially to scientific literature. She prepared the palm genera list for *Standardized Plant Names*, and was co-author of the Forest Service publication *Range Plant Handbook*.

## Frank Woods Wins Junior Member Award

Frank W. Woods, Instructor, Department of Botany, University of Tennessee, Knoxville, received the Junior Member Award at the Knoxville meeting of the Kentucky-Tennessee Section, Society of American Foresters. The cash award is presented annually by the Section to the junior member who submits the best technical report during the year. Subject of Mr. Wood's winning paper is: "Disease As A Factor In The Evolution Of Forest Composition." Harry Nadler (right), retiring chairman of the Section, is shown making the presentation.

## Publication of C.I.F.-S.A.F. Meeting Papers

By mutual agreement technical papers delivered by C.I.F. members at the November joint meeting of Canadian and U. S. foresters will appear in *The Forestry Chronicle* and those by S.A.F. members in the JOURNAL.

Arrangements have been made with the editor of the *Chronicle* to have extra copies printed of the issues carrying meeting papers. These may be purchased at the regular rate of $1 per copy from the editor, Kingsley F. Harris, 3356 West 30th Ave., Vancouver 8, B.C., Canada. Extra copies of the JOURNAL which carry meeting papers will also be made available for purchase by Canadian foresters.

The December 1952, issue of *The Forestry Chronicle* carries the following papers:

Trends in North American Forestry—W. A. Bentley

Trends in North American Forestry, Summation address—George A. Garratt

Good Logging Practices Increase Forest Yields—J. A. Doyle

Effect of Recent Pulp and Paper Developments in British Columbia on the Forests—Thomas G. Wright

The Place of Vocational Training in the Professional Forestry Curriculum—Lowell Besley

Public Policy Regarding Forest Lands in Canada—Murray B. Morison

Interpreting Forestry to the Layman—J. L. Van Camp

Forest Management in Ontario—H. Kennedy

The Correlation of Silvicultural Systems and Wildlife Management—D.R.M. Scott and C. David Fowle

## Candidates for Membership

Candidates for admission, advancement, or reinstatement whose membership applications were received in the Society office during the month of December are listed below.

Action regarding the eligibility of these candidates will be taken by the Council as of March 1, 1953. Any communications from voting members relating to the membership eligibility of any of these candidates should be received in the Society office prior to that date.

### Allegheny Section

*Student Grade*

PENNSYLVANIA STATE COLLEGE

Craul, J. P.
Lewis, R. P.
Loucks, D. P.
Roberts, J. P.
Stefanik, P. T.

*Junior Grade*

Ibberson, J. E., Chief, Div. of Research, Dept. of Forests and Waters, Harrisburg, Pa.; Pa. State, B.S.F., 1947; Yal., M.F., 1945.
Ritter, W. C., 236 Springdale Ave., Yardville, N. J.; Iowa State, B.S.F., 1952. (Student, 1952).

*Member Grade*

MacDonald, J. C., New Gretna, N. J.; Univ. of Me., B.S.F., 1928. Reinstatement.

### Appalachian Section

*Junior Grade*

Crank, P. F., Jr., Currituck County, N. C.; N. C. State, B.S.F., 1952. (Student, 1952).
Hadley, L. C., Park Rgr., Shenandoah Natl. Park, Luray, Va.; Univ. of Me., B.S.F., 1950.
Malac, B. F., Forest Asst., Duke Forest, Durham, N. C.; Duke, M.F., 1952.

*Member Grade*

Brierley, R. P., Dist. Forester, Va. Forest Service, Farmville, Va. (Aff. 44, J46).
Gardner, C. S., Field Repre., N. C. Pulp Co., Plymouth, N. C.; Univ. of Me., B.S.F., 1942. (Junior, 1946).
Grau, M. F., Forester, Va. Thr. Corp., Altavista, Va.; Iowa State, B.S.F., 1936. (Junior, 1946).
Witter, C. J., Mgmt. Chief, Va. Forest Service, Charlottesville, Va.; State Univ. of New York, B.S.F., 1942. (Junior, 1946).

### Central Rocky Mountain Section

*Student Grade*

COLORADO A & M COLLEGE

Alexander, D. S.
Roberts, N. L.
Snyder, D. E.

*Junior Grade*

Fye, D. J., Mgr., Fullerton Lbr. Co., Valley, Nebr.; Iowa State, B.S.F., 1950.
Hatcher, O. K., Lumberman, Johnson Cashway Lbr., Omaha, Nebr.; Iowa State, B.S.F., 1950.

### Central States Section

*Junior Grade*

Denmark, E. E., Sales Repre., Hill-Behan Lbr. Co., Chicago, Ill.; Iowa State, B.S.F., 1949.
Lange, J. R., Sr. Forester, Forest Preserve Dist., River Forest, Ill.; Iowa State, B.S.F., 1947.
Lewis, W. K., Dist. Forester, State of Ill., Jerseyville, Ill.; Mich. State, B.S.F., 1939.
McGrath, T. J., Lbr. Buyer, Brunswick, Balke, Collender Co., Chicago, Ill.; Iowa State, B.S.F., 1949.
TePekson, M. W., Party Chief, 13323 Emily St., East Cleveland, Ohio; Univ. of Minn., B.S.F., 1950.

### Columbia River Section

*Junior Grade*

Ellingsen, T. S., Asst. Forester, Menasha Wooden Ware Corp., Coos Bay, Oreg.; Oregon State, B.S.F., 1950.
Gibson, W. K., Bur. of Land Mgmt., Medford, Oreg.; Mont. State, B.S.F., 1952. (Student, 1952).
Gower, J. A., Edward Hines Lbr. Co., Hines, Oreg.; Iowa State, B.S.F., 1950.
Heisler, H. P., Forester, U.S.F.S., Pendleton, Oreg.; State Univ. of N. Y., B.S.F., 1950.
Hills, F. M., Woods Foreman, J. Neil's Lbr. Co., Klickitat, Wash.; Univ. of Wash., B.S.F., 1950.
Knop, B. M., Production Expeditor, Kerns Co. of Oregon, Ltd., Pilot Rock, Oreg.; Iowa State, B.S.F., 1950.

Russell, H. J., Forester, Bur. of Land Mgmt., Medford, Oreg.; Univ. of Minn., B.S.F., 1950.
Trafton, G. B., Scaler, Crown Zellerbach Corp., Molalla, Oreg.; Univ. of Wash., B.S.F., 1950.
Welker, L. J., Forester, Bur. of Land Mgmt., Roseburg, Oreg.; Univ. of Idaho, B.S.F., 1950.

*Member Grade*

Burgess, R. C., Private Forester, 3100 Broadway, Baker, Oreg. Reinstatement.
Good, V. A., Cons. Forester, 120 Ash Ave., Troutdale, Oreg.; Univ. of Idaho, B.S.F., 1940. (Junior, 1946).

*Affiliate Grade*

Allison, C. R., Weyerhaeuser Hq., Castle Rock, Wash.; Wash. State, B.S., (Forestry), 1947.
Izett, J. M., Forester, C. W. Guerrier Lbr. Co., Springfield, Oreg.; Wash. State, B.S., (Forestry), 1942.

**Gulf States Section**

*Junior Grade*

Holland, J. J., Cons. Forester, Int. Paper Co., Natchez, Miss.; La. State, B.S.F., 1952.
Rochester, Service Forester, La. Forestry Comm., Hammond, La.; La. State, B.S.F., 1950.

*Member Grade*

Gunter, E. R., Asst. Dist. Forester, La. Forestry Comm., Woodworth, La.; La. State, B.S.F., 1942. (Junior, 1946).
Wall, R. T., Asst. Chief, Info., and Ed., La. Forestry Comm., Baton Rouge, La.; La. State, B.S.F., 1941. (Junior, 42R49).

**Inland Empire Section**

*Student Grade*

UNIVERSITY OF IDAHO

Johnson, L. C.

*Junior Grade*

Campbell, D. P., Forester, Idaho State Forestry Dept., Coeur d'Alene, Idaho; Univ. of Idaho, B.S.F., 1950.
Menne, D. C., Scaler, Potlatch Forests, Inc., Headquarters, Idaho; Iowa State, B.S.F., 1951.
Puckett, J. V., Fire Control Aide, U.S.F.S., Nordman, Idaho; Pa. State, B.S.F., 1950.

**Intermountain Section**

*Junior Grade*

Zink, R. C., Park Rgr., Craters of the Moon Natl. Monument, Arco, Idaho; Oregon State, B.S.F., 1948; Colo. A & M., M.F., 1950.

**Kentucky-Tennessee Section**

*Junior Grade*

Stewart, G. W., Cabinet Quality Control Mgr., Magnavox Co. of Tenn., Greeneville, Tenn.; Purdue, B.S.F., 1950.

**New England Section**

*Student Grade*

UNIVERSITY OF MAINE

Card, C. M. — Sabaites, C. J.
Hall, G. — Wilson, R. P.
Robbins, W. C.

**New England Section**

*Junior Grade*

Rendall, R. R., 6 School St., Augusta, Me.; Univ. of Me., B.S.F., 1950.
Sisson, J. W., Forestry Field Man, Brown Co., Berlin, N. H.; N. C. State, B.S.F., 1950.

*Affiliate Grade*

Foster, E. R., Executive Director, Conn. River Watershed Council, Inc., Greenfield, Mass. Reinstatement.

**New York Section**

*Associate Grade*

Nicholson, G. W. E., Vice-Pres., Union Bag and Paper Corp., New York, N. Y.

**Northern California Section**

*Junior Grade*

Acker, H. R., 1863 San Lorenzo Ave., Berkeley, Calif.; Univ. of Calif., B.S.F., 1951.
Corps, E. L., Forester, U.S.F.S., Placerville, Calif.; Utah State, B.S.F., 1951.
Crankshaw, W. B., Dispatcher, Tahoe Natl. Forest, Camptonville, Calif., Purdue, B.S.F., 1951.
Gilliam, L. N., Forest Tech., Pac. Lbr. Co., Scotia, Calif.; Mont. State, B.S.F., 1951.
Gordon, D. K., Asst. Forester, Fruit Growers Supply Co., Susanville, Calif.; Univ. of Calif., B.S.F., 1948.
Knowles, G. E., Forester, U.S.F.S., Happy Camp, Calif.; Oregon State, B.S.F., 1951.
McCloskey, D. R., 403 E. 11th St., Hanford, Calif.; Univ. of Calif., B.S.F., 1950.
Sombs, R. J., Hq. Asst., Shasta Natl. Forest, Dunsmuir, Calif.; Univ. of Minn., B.S.F., 1950.

*Member Grade*

Branagh, H. E., Resource Staff Officer, U.S.F.S., Nevada City, Calif.; Univ. of Calif., B.S.F., 1937. Reinstatement.
Sindel, J. E., Forest Tech., 135 Ridgeway Ave., Santa Rosa, Calif.; Univ. of Calif., B.S.F., 1939. (Junior, 1946).

*Affiliate Grade*

Spangler, A. A., Forester, Chico Wood Products Co., Chico, Calif.

**Northern Rocky Mountain Section**

*Student Grade*

MONTANA STATE UNIVERSITY

Edstrom, N. A. — Karr, R. W.
Hill, E. B. — Weistaner, D. A.

*Junior Grade*

McDougal, J. J., Asst. Rgr., U.S.F.S., Townsend, Mont.; Mont. State, B.S.F., 1951.

**Ozark Section**

*Junior Grade*

Barrington, B. Q., Forester, Fordyce Lbr. Co., Fordyce, Ark.; A.P.I., B.S.F., 1949.
Graham, R. G., Jr., Forester, Caddo Dist., Quachita Natl. Forest, Glenwood, Ark.; Utah State, B.S.F., 1949.
Nitz, J. H., Asst. Dist. Rgr., U.S.F.S., Oden, Ark.; Univ. of Minn., B.S.F., 1950.
Timko, P. A., Forester, U.S.F.S., Booneville, Ark.; Iowa State, B.S.F., 1949.

*Member Grade*

Batchelor, J. P., Head Scaler, Int. Paper Co., Cullendale, Ark.; La. State, B.S.F., 1938. (Junior, 1946).
Ray, H. C., Forest and Range Supv., S.C.S., Fayetteville, Ark.; Utah State, B.S.F., 1948; Yale, M.F., 1949. (Junior, 1948).
Spilsbury, B. J., Dist. Forest Rgr., Hector, Ark.; Utah State, B.S.F., 1939. (Junior, 1949).
William, R. D., Dist. Forester, Mo. Cons. Comm., Eminence, Mo.; Purdue Univ., B.S.F., 1949. (Junior, 1949).

**Puget Sound Section**

*Junior Grade*

Avery, R. G., Forester, Manning Seed Co., Seattle, Wash.; Univ. of Wash., B.S.F., 1949.
Bandel, J. R., Cruiser, Weyerhaeuser Tbr. Co., Snoqualmie, Wash.; Univ. of Minn., B.S.F., 1949.
Brent, H. L., State Cave Biologist, Wash. State Game Dept., Elma, Wash.; Simpson College, B.A., (Biology), 1943; La. State, M.S., 1948.
Miles, W. R., Land Agent, Weyerhaeuser Tbr. Co., Montesano, Wash.; Univ. of Minn., B.S.F., 1949.
Schmidt, M., Jr., Logging Mgr., Simpson Logging Co., Shelton, Wash.; Univ. of Wash., B.S.F., 1948.

**Southeastern Section**

*Junior Grade*

Hall, J. M., H. W. Hall Co., Moultrie, Ga.; Univ. of Ga., B.S.F., 1948. Reinstatement.
Harris, K. L., Box No. 2, Bunnell, Fla.; Univ. of Fla., B.S.F., 1951.
Lawand, L. D., Field Asst., Int. Paper Co., Richmond Hill, Ga.; Univ. of Me., B.S.F., 1950; Duke, M.F., 1951.

**Southwestern Section**

*Member Grade*

Beveridge, W. M., Forest Supv., Prescott Natl. Forest, Prescott, Ariz.; Iowa State, B.S.F., 1929. (Junior, 1946).
Koogler, W. G., Asst. Chief, U.S.F.S., Albuquerque, N. Mex. (Junior, 1946).


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**Upper Mississippi Valley Section**

*Junior Grade*

Chapman, R. C., Research Dept., Curtis Companies, Inc., Clinton, Iowa; Iowa State, B.S.F., 1951.
Dahlstrom, W. A., Farm Forester, Div. of Forestry, Litchfield, Minn.; Univ. of Minn., B.S.F., 1951.
Finch, C. D., Design Engr., Beam Mfg. Co., Webster City, Iowa; Iowa State, B.S.F., 1950.
Kallio, E., Forester, Iron Range Resources and Rehabilitation Comm., Walker, Minn.; Univ. of Minn., B.S.F., 1950.


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Kinney, G. H., Tbr. Appraiser, Crow Wing County, Brainerd, Minn.; Univ. of Minn., B.S.F., 1951.
Ringold, S. B., Asst. Forester, Minn. and Ontario Paper Co., Big Falls, Minn.; Univ. of Minn., B.S.F., 1950.
Stoppel, D. E., Dist. Forester, Iowa State Cons. Comm., Adel, Iowa; Iowa State, B.S.F., 1951.

*Affiliate Grade*

Clarke, E. K., Jr., Nursery Foreman, North Star Tbr. Co., Duluth, Minn.; Univ. of Minn., (4 Yrs.) (Forestry).

**Wisconsin-Upper Michigan Section**

*Junior Grade*

Hungate, G. E., Deputy Inspt., Natl. Hardwood Lbr. Assoc., Iron Mountain, Mich.; Iowa State, B.S.F., 1951.
Sainio, E. N., Forester, Escanaba Paper Co., Newberry, Mich.; Mich. State, B.S.F., 1943.
Thomson, G. J., Tree Farm Forester, Port Blakely Mill Co., M'Cleary, Wash.; Univ. of Wash., B.S.F., 1949.

*Affiliate Grade*

Leslie, F., Mgr., Wm. Bonifas Lbr. Co., Marenisco, Mich.; Univ. of Toronto, B.S., (Forestry), 1951.

**Foreign**

*Member Grade*

Kirkham, D. P., Chief, Forestry Sub-Section, United Nations Civil Assistance, Command Korea; Univ. of Minn., B.S.F., 1928, Reinstatement.

## Acceptance of H. R. Blanford

The following is the text of a letter received by President Drake:

November 25, 1952

Dear Mr. Drake:

I feel myself very highly honored by the Society of American Foresters in electing me an Honorary Member.

Please convey my best thanks to your Council and with hearty greetings to the Society of which I am very proud indeed to be a Member,

I remain,

Yours sincerely,

H. R. BLANFORD

## Coming Events

### Allegheny Section Meeting

The annual winter meeting of the Allegheny Section will be held February 26, 27, and 28 in the Sylvania Hotel, Locust Street just off Broad, Philadelphia 7, Pa.

The Section's business session will be held on the afternoon of February 27 and the banquet that evening.

Secretary of the Section is Harvey R. Frantz, Dodson Building, 528 N. New Street, Bethlehem, Pa.

### Northern Rocky Mountain Section

A meeting of the Northern Rocky Mountain Section will be held in Missoula, Mont. on February 18.

Additional information may be obtained from A. E. Spaulding, chairman, U. S. Forest Service, Federal Building, Missoula.

### North American Wildlife Conference

The 18th North American Wildlife Conference will be held in the Statler Hotel, Washington, D. C. on March 9-11.

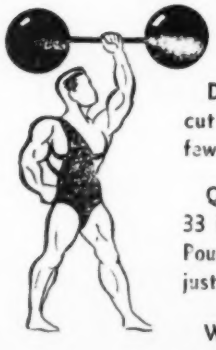
Information about the program may be obtained from the Wildlife Management Institute, Wire Building, Washington 5, D. C.

There will be a meeting of the S.A.F. Division of Forest Wildlife Management in connection with this conference. The Division's secretary is Galen Pike, Box 338, Duluth, Minn.

### Columbia River Section Meeting

The annual meeting of the Columbia River Section will be held in Portland, Oreg. on April 9 and 10. A field trip has been scheduled through the Portland City Forest on the afternoon of April 9. The following day there will be four one-hour sessions arranged by the Chapters, and a dinner meeting that evening.

The Section secretary is Kenneth Burkholder, Box 705, Bend, Oreg.

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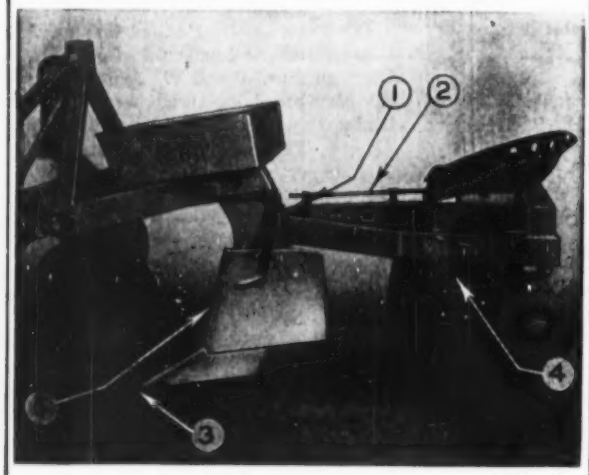


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# Forestry News

## Yale Forestry School Outlines 1953 Scholarship Plans

Yale University School of Forestry announces that a number of fellowships, scholarships, and assistantships will be available for 1953-54 for qualified graduate students who desire to pursue courses of study leading to the degree of Master of Forestry (M.F.), Doctor of Forestry (D.For.), or Doctor of Philosophy (Ph.D.). In the case of assistantships, consideration will also be given to qualified men who may wish to carry on part-time programs of study without reference to a degree.

A limited number of fellowships, with stipends ranging from $600 to $1,200, are generally restricted to students taking the final year of the Master of Forestry program and to those working toward the doctorate.

Recipients of fellowship awards will be required to pay tuition charges ($450 for M.F., D.For., and Ph.D. degrees) and such laboratory fees as may be involved in their particular programs of study. However, no assistance in teaching or research or other service is required.

Several scholarships are available, covering the cost of tuition only.

A number of research assistantships are available in connection with a long-range study of the properties of tropical woods. These may involve either half-time work on the project (and half-time study for a degree) at a rate of pay of $125 per month during the academic year, or up to 10 or 12 hours of work per week at an hourly rate of pay. Prior experience or training in wood technology is not a prerequisite for an assistantship, and appointments will not necessarily be restricted to students specializing in wood technology.

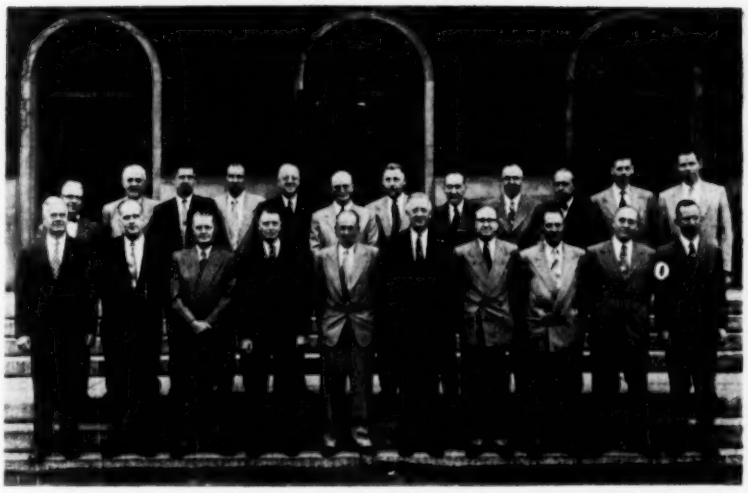
Students receiving assistantships will be required to pay tuition charges and laboratory fees, but tuition charges are reduced by almost one-half for assistants working on a half-time basis. Income derived from assistantships is subject to regular withholding tax deductions.

Applications for fellowships, scholarships and assistantships for 1953-54 should be filed by March 2, 1953. They should include transcripts of scores on the graduate record examination. Applicants who have not already taken this examination should arrange to do so at the regular national testing in February.

The School of Forestry, organized entirely on a graduate basis as one of the seven professional schools of Yale University, offers instruction leading to the Master of Forestry and Doctor of Forestry degrees. The degree of Doctor of Philosophy is also offered in Forestry, but administered by the Yale Graduate School.

Men with full undergraduate training in forestry normally require one academic year of resident study to meet the requirements for the Master of Forestry degree. This one-year program is intended to provide advanced instruction in forest ecology and soils, applied silviculture, forest management, lumbering, wood technology, forest products, forest economics, forest pathology, and allied fields of forestry.

The programs of study leading to the degrees of Doctor of Forestry and Doctor of Philosophy are primarily designed for men who have already received master's degrees in forestry or closely allied fields and who wish to prepare themselves for careers in research or education.



EXECUTIVES OF THE country's forest schools are pictured above at the start of their fifth annual conference preceding the 52nd annual Society of American Foresters meeting in Montreal. On November 15, 1952, the executives were the guests of State University of New York College of Forestry at Syracuse, where they posed in front of Louis Marshall Memorial Building on the occasion of their first meeting at one of the member colleges.

Front row, left to right, are: Hardy L. Shirley, dean, State University College of Forestry at Syracuse; Richard J. Preston, director, North Carolina State College of Agriculture and Engineering, Division of Forestry, Raleigh; Ross A. Williams, dean, School of Forestry, Montana State University, Missoula; Robert Ashman, head, Department of Forestry, University of Maine, Orono; Ralph W. Hayes, director, Department of Forestry, Louisiana State University, Baton Rouge; Gordon D. Marckworth, dean, College of Forestry, University of Washington, Seattle; Stanley G. Fontanna, dean, School of Forestry and Conservation, University of Michigan, Ann Arbor; J. Whitney Floyd, head, School of Forestry, Range and Wildlife Management, Utah State Agricultural College, Logan; W. C. Percival, head, Division of Forestry, West Virginia University, Morgantown; Clinton H. Wasser, head, School of Forestry and Range Management, Colorado Agricultural and Mechanical College, Fort Collins.

Second row, left to right, are: E. R. Martell, head, Department of Forestry and Conservation, Purdue University, Lafayette, Ind.; D. S. Jeffers, dean, School of Forestry, University of Idaho, Moscow; D. J. Weddell, dean, School of Forestry, University of Georgia, Athens; Terrill D. Stevens, head, Department of Forestry, Michigan State College, East Lansing; Clarence F. Korstian, dean, School of Forestry, Duke University, Durham, N. C.; Clemens M. Kaufman, head, School of Forestry, University of Florida, Gainesville; George A. Garratt, dean, Forest School, Yale University, New Haven, Conn.; R. H. Westfeld, head, Department of Forestry, University of Missouri, Columbia; Walter F. McCulloch, acting dean, School of Forestry, Oregon State College, Corvallis; Wilbur B. DeVall, head, Department of Forestry, Alabama Polytechnic Institute, Auburn; M. K. Goddard, head, Pennsylvania State Forest School, State College, Pa.; Prof. John Zivnuska, School of Forestry, University of California, Berkeley.

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Application blanks for fellowship and scholarship aid and for admission may be obtained from the Registrar, Yale School of Forestry, 205 Prospect Street, New Haven 11, Connecticut. Men interested in assistantships should correspond with the Dean at the same address.

## Lawrence Leney Joins Missouri Forestry Staff

Wood technologist Lawrence Leney has joined the staff of the University of Missouri Forestry Department, Dr. R. H. Westveld, chairman of the department, announced recently.

Leney, formerly an instructor at the College of Forestry, State University of New York, will teach wood technology at Missouri while continuing research in the effect of different woodcutting tools on woods and finished products. Co-author of *Ninety-one Paper Making Fibers*, just off the press, he is a member of the Society of American Foresters, Forest Products Research Society, and other honorary societies.

A native of New York state, Leney received both the bachelor's and master's degrees from Syracuse and is now at work on his doctorate.

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## Harvard Announces Fellowships in Silvicultural Research

Harvard University announces the Richard Thornton Fisher Research Fellowships designed to encourage study and research in silviculture. Three fellowships with fixed stipends of $2,000 each are available. They are to defray the expenses of tuition, living, and incidental travel for a period of approximately 15 months. The fellowships will enable students to matriculate in the Harvard Graduate School of Arts and Sciences, and to work in residence toward a master's degree in forestry, or toward a doctor's degree in biology with particular reference to silvicultural problems.

The fellowships are open to those who hold bachelor's degrees from undergraduate schools of forestry or from colleges of liberal arts. Graduates of the latter schools must have majored in biological science.

Applications must be filed with the Graduate School of Arts and Sciences, 24 Quincy Street, Cambridge 38, Mass., by March 1. Further information and application blanks may be obtained from the office of the Graduate School or from the Director of the Harvard Forest, Petersham, Mass.

## R. C. Deckert Named To New York College Post

Russell C. Deckert, recently appointed industry specialist in forest utilization at State University of New York College of Forestry at Syracuse will serve as liaison between the college and the wood-using industries of New York State, consulting with industry men on problems in wood supply, forest products manufacture, personnel needs, and related matters of concern both to forest industry and education.

A native of Palmyra, Pa., Deckert joined the College of Forestry faculty in October after six years as assistant professor of wood utilization at Michigan State College, East Lansing. Previously manager of wood procurement for the Campbellsville Cooperage Co., Campbellville, Ky., and at Curtiss-Wright Corporation a wood technologist, he has also been a farm forester and research assistant for the U. S. Forest Service.

Deckert, a 1938 graduate of the University of Georgia, received the Master of Forestry degree from Duke University in 1943. He is a member of the Forest Products Research Society, Society of American Foresters, and Xi Sigma Pi, forestry honorary fraternity.

### L. E. Chaiken Joins Duke University Faculty

Leon Edward Chaiken joined the Duke University Forestry School faculty recently as associate professor of forest management and assistant director of the Duke Forest, according to Dean Clarence F. Korstian.

Chaiken was associated with the Southeastern Forest Experimental Station at Asheville, N. C., for 18 years.

He holds the Master of Forestry degree from Cornell University, and has contributed articles on southern forestry to leading professional journals. He is currently chairman of the Appalachian Section of the Society of American Foresters.

### Conference Held on Forest Insects

The Western Forest Insect Work Conference, an international group covering western Canada as well as the United States, held its fourth annual meeting at Victoria, B. C., December 8 to December 10.

Hector A. Richmond of Victoria, officer-in-charge, Forest Insect Investigations, British Columbia, is chairman for 1952-1953. Membership of the group, organized four years ago, is made up of forest entomologists and others interested in the professional aspects of forest entomology. Heads of forest insect laboratories, educators from western universities giving courses in forestry and entomology, and other interested persons usually attend the conferences. Current research, insect situations, and developments are reviewed informally. The gatherings serve as a medium of exchange of information and material for the university teaching staffs.

Secretary-treasurer of the group is Philip C. Johnson, forest insect laboratory, U. S. Bureau of Entomology and Plant Quarantine, Coeur d'Alene, Idaho. Directors are R. L. Furniss, officer-in-charge, forest insect laboratory, Portland, Oreg.; Dr. N. D. Wygant, officer-in-charge, forest insect laboratory, Fort Collins, Colo., and W. G. Mathers, officer-in-charge, forest insect laboratory, Vernon, B. C.

The program for the 1953 meeting to be held in northern Idaho will be prepared by a committee consisting of Dr. Morris James, State College of Washington, Pullman, chairman; Dr. W. F. Barr, University of Idaho; Mr. Johnson, and Jack Walters, forest insect laboratory, Vernon, B. C. No date for the 1953 meeting has been set.

### Independent Forest Owners Organize

Formation of a new association to further the mutual interest of individual forest owners was announced by Charles H. Stoddard, Minong, Wisconsin, executive director. The new INDEPENDENT FOREST FARMERS OF AMERICA has been organized to assist four million owners in improving the management of their lands and making them more profitable.

"Most small owners have difficulties in finding good markets, obtaining current prices of forest products, practicing selective logging and registering under reduced forest tax laws," Director Stoddard pointed out. "It is the purpose of the IFFA to supply all types of useful information needed by the owners and to make available a special consulting service on individual problems. Legislative matters as well as general measures to further sound forest management will also be handled by the new association in the interest of its membership."

An advisory board composed of forest owners and well known foresters in the United States will guide the policies of the IFFA. Active management of the association will be handled by Mr. Stoddard, a forest farmer and a graduate professional forester, assisted by John L. Sprague, secretary-treasurer. Headquarters offices of the new association will be located at 441 Ridgewood Avenue in Minneapolis and field offices will be maintained at Minong, Wisconsin. Anyone who owns forest land is eligible for membership in the IFFA.

### Additions and Changes in A.F.P.I. Staff

Nort Baser, former editor of *American Forests*, has joined the staff of American Forest Products Industries, Inc.

Ronald Richardson has been named assistant managing director but will continue also as editorial director, the position previously held by him. Robert Rutherford of the Georgia Forestry Commission has recently joined the editorial staff.

Williams S. Edmunds, formerly executive director of the North Carolina Forestry Association, and more recently a special field representative for A. F. P. I., has been named head of the industrial division.

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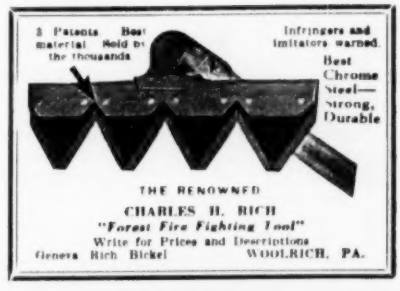
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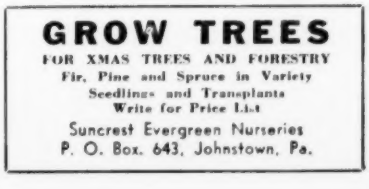
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## AFPI Elects New Officers

James L. Madden, Hollingsworth & Whitney Co., Boston, has been re-elected president of American Forest Products Industries, Inc. Two new trustees have been named to the board: Robert H. Evans, Olin Industries, Inc. Shreveport, La. and Clyde Morgan, Rayonier, Inc., New York. Officers re-elected are: Col. W. B. Greeley, chairman of the board; Clyde S. Martin, Weyerhaeuser Timber Co., Tacoma, Wash., Walter J. Damtoft, Champion Paper & Fibre Co., Canton, N. C., vice-presidents; P. H. Glatfelter, P. H. Glatfelter Co., Spring Grove, Pa., treasurer; C. A. Gillett of Washington, D. C., secretary.

## Forest Farmers Association Lounches School Program

The Forest Farmers Association of Valdosta, Ga. recently launched a program aimed at making more and better forestry information available to school children in the South.

The association's official monthly publication, *The Forest Farmer*, has inaugurated a forestry page for school children, designed both for teachers, and for F.F.A., 4-H, and high school science class boys and girls.

Association President J. V. Whitfield described the program as a simple and inexpensive way to localize forestry education, and a fine project for "Keep Green" groups, Rotary, Lions, and Kiwanis Clubs, Chambers of Commerce, wildlife leagues, and progressive wood-using industries. A special school subscription rate is being offered as part of the program.

The first three school pages are being prepared by Ralph T. Wall, the Louisiana Forestry Commission's chief of forest information.

The second series will be prepared by Richard Davis, information chief of the Georgia Forestry Commission and editor of the monthly magazine, *Georgia Forestry*.

### Stealey General Manager of Pulpwood Producers, Inc.

The Independent Pulpwood Producers, Incorporated, of Cleveland, Texas, announce the appointment of Charles T. Stealey, Jr. as general manager, to fill the position left vacant by the resignation of Bruce F. Stewart.

Mr. Stealey graduated from West Virginia University in 1949, and was awarded the M.F. degree by Yale University in 1950.

Formerly employed by the Texas Forest Service as assistant district forester at Lufkin and later as district forester at Conroe, before his appointment to the Texas Forest Service Stealey served as junior forester for the Southern Railway at Dorchester, S. C.

### What's Your Tax I.Q.?

Come the Ides of March—comes also federal income tax time. Do you know your federal taxes—what they can do to you—what you can do to them? Try this three-minute tax quiz. (Editor's note: three minutes if you're an expert.) It is based on material furnished by the American Institute of Accountants, the national professional society of certified public accountants.

Answers are on page 160.

1. Your son worked for you in the business last summer, and you paid him a total of $591. He also won $10 in an advertising slogan contest. You can—
   a. Take a full $600 dependency exemption for him.
   b. Take a half exemption.
   c. Take no exemption.
2. While on vacation with your wife last summer, you entertained several men you do business with. Is this—
   a. Deductible as a business expense?
   b. Not deductible, since you were vacationing?
   c. Deductible only if you and your wife file a joint return?
3. You made a non-business loan of $2,000 to a friend last March, and he promptly disappeared, leaving absolutely no trace. You can probably—
   a. Deduct the full amount as a bad debt on your 1952 return.
   b. Deduct only half of it.
   c. Take no deduction at all.
4. You earned more than $3,600 in your business. The social security tax is—
   a. Not levied on your own income.
   b. $81, paid with your income tax return.
   c. $54, paid to the Social Security Board.
   d. $54, paid with your income tax return.
5. Which of the following contributions is not deductible,
   a. Your local Community Chest.
   b. The American Legion.
   c. A political party.
   d. The YMCA.
6. You failed to take all your allowable deductions on your 1950 return. You can—
   a. No longer file a claim for a refund.
   b. File a refund claim as late as 1954.
   c. Stop worrying, since you will get a refund automatically.
7. Your wife works for you in your business. She—
   a. Is required to pay social security.
   b. Is not subject to social security.
   c. Can choose whether she does or does not want social security coverage.
8. In December, you spent $1,000 for built-in bookshelves and wall-to-wall carpeting for your office, on which your lease has three years to run. You can—
   a. Deduct the $1,000 on your 1952 return.
   b. Amortize the cost over the next three years.
   c. Depreciate it over the life of the furnishings.
9. There are a few leaks in the shingle roof of your office building, so you construct a new tile roof. Taxwise, the cost is—
   a. Deductible as a repair.
   b. Deductible in the current year as an improvement.
   c. Depreciable—a portion deductible each year of its useful life.
10. In determining your taxable income, which of the following taxes you pay is *not* allowed as a deduction?
    a. Real estate tax.
    b. State income tax.
    c. State inheritance tax.
    d. Motor vehicle license fee.


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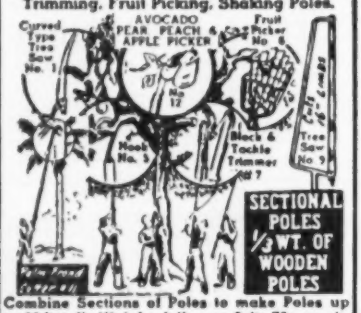


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## Weyerhaeuser Shows Trends in Industrial Forestry Work

The Weyerhaeuser Timber Company, with executive offices at Tacoma, Washington, is reported to employ more technically trained foresters than any other individual private corporation in the world. An early leader in the commercial growing of timber crops, this company has also led in the use of professional foresters as industrial employees.

With the mounting number of foresters employed by industry, the profession as a whole becomes vitally interested in the scope of activity of its members in industrial employ. How the Weyerhaeuser company makes use of its foresters should be an excellent indication of trends.

The job classification of Weyerhaeuser foresters as of November 1, 1952 is given in Table 1. The schools at which they received their undergraduate training are shown in Table 2.

TABLE 1.—NUMBER OF GRADUATE FORESTERS BY JOB CLASSIFICATION

| | For[1] estry | Logging[2] engr. | Woods[3] | Office[4] | Mfg.[5] | Pulp[6] | Pulp[7] research | Sales[8] | Adm. or[9] exec. | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| | 2 | | | | | | | | | 2 |
| | 6 | 2 | 1 | | 3 | | | | | 12 |
| | | | | | | | | 1 | | 1 |
| | 5 | 1 | 1 | 2 | | | | | 2 | 11 |
| | 12 | 3 | 7 | | 9 | 3 | 6 | 1 | | 41 |
| | 2 | | | | | | | | | 2 |
| | 3 | 3 | 1 | | | | | | | 7 |
| | 9 | 1 | | | 1 | | | 1 | 1 | 13 |
| | 24 | | | 1 | | | 2 | 5 | 3 | 35 |
| | 6 | 3 | | | | | | | | 9 |
| | 3 | 1 | | | | | | | 1 | 5 |
| | 3 | | | | | | | | | 3 |
| Total | 75 | 14 | 10 | 3 | 13 | 3 | 8 | 8 | 7 | 141 |

[1]Forestry department personnel, cruisers, land agents and contract supervisors.
[2]Woods engineering and road and railroad construction.
[3]Loggers, all departments except forestry and engineering, scalers, boom men.
[4]Time keepers, safety, accountants, statistical and other miscellaneous office work other than forestry.
[5]Lumber, plywood and by-products manufacture. Excludes pulp.
[6]Manufacture and control.
[7]Forest products research and development.
[8]Sales or purchases of lumber, plywood, pulp and by-products.
[9]Administrative or executive positions in all departments of the company. Includes logging superintendents, branch managers, division and department heads.

TABLE 2.—NUMBER OF GRADUATE FORESTERS FROM EACH SCHOOL BY JOB CLASSIFICATION

| Undergraduate School | Forestry | Logging engr. | Woods | Office | Mfg. | Pulp | Prod. research | Sales | Adm. or exec. | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| U of California | 1 | | | | 1 | | | 1 | | 3 |
| Colorado A & M | 3 | | | | 2 | | | | | 5 |
| U of Idaho | 8 | | | | | 1 | 1 | | | 10 |
| Iowa State College | 6 | | 1 | 1 | 1 | | | | | 9 |
| U of Maine | 1 | | | | | | | | | 1 |
| Mich. State College of Mining & Tech. | 1 | | | | | | | | | 1 |
| Mich. State College | 2 | | | | | | 1 | 1 | | 4 |
| U of Michigan | 5 | 1 | | | 1 | 1 | 1 | | | 9 |
| U of Minnesota | 11 | 1 | 1 | | | | | | 2 | 15 |
| U of Missouri | 1 | | | | 1 | | 1 | | | 3 |
| Montana State U | 1 | | | | 2 | | | | | 3 |
| U of New Hampshire | 1 | | | | | | | | | 1 |
| State U of New York College of Forestry | 1 | | | | | | 2 | 1 | 1 | 5 |
| Oklahoma A & M | 2 | | | | | | | | | 2 |
| Oreg. State College | 9 | 4 | 2 | 1 | | | | 1 | | 17 |
| Penna. State College | 1 | | 2 | | | | 1 | 1 | | 5 |
| Purdue U | | | 3 | | | | | | | 3 |
| Utah State Ag. Coll. | 1 | | | | | | | | | 1 |
| U of Washington | 16 | 7 | 1 | 1 | 3 | 1 | 1 | 2 | 3 | 35 |
| Wash. State College | 3 | | | | 1 | | | | | 4 |
| Yale U | 1 | | | | 1 | | | 1 | 1 | 4 |
| Fed. U of Tech., Zurich, Switz. | | 1 | | | | | | | | 1 |
| Total | 75 | 14 | 10 | 3 | 13 | 3 | 8 | 8 | 7 | 141 |

### All-Wood Truck Body Returns to Vehicle Market

The return of lumber to one of its largest former markets may be heralded by the new all-wood Army truck body displayed for the first time during the annual meeting of National Lumber Manufacturers Association in Washington recently.

Designed and constructed by laboratory personnel of Timber Engineering Company in cooperation with Army Ordnance and Corps of Engineers officials, the new truck body is a project of the hardwood industry's research program.

An innovation in military vehicle manufacture, the construction of the new truck body employs the latest developments in wood technology, including those being applied successfully in the Navy's minesweepers and other modern shipbuilding programs.

A far cry from the old box-like wood truck bodies of World War II, the new all-wood body is much stronger, yet lighter in weight. Complete information is available from Timber Engineering Company, 1319 Eighteenth Street, N. W., Washington 6, D. C.

### Westvaco Appoints Gustafson Experimental Forest Manager

Appointment of Richard O. Gustafson as manager of Westvaco Experimental Forest, near Georgetown, S. C., was announced recently by officials of West Virginia Pulp and Paper Company of New York.

Mr. Gustafson succeeds Peter T. Lannan, Jr., manager of the experimental forest since 1947, who recently was promoted as technical assistant to W. J. Bailey, vice president in charge of the company's wood department and woodlands.

The experimental forest is a 20,000-acre tract where trained foresters undertake continuing studies of timber harvesting and growing techniques. These are applied not only to the company's own timber operations, but also passed on to outside suppliers of pulpwood.

Mr. Gustafson is a graduate of the University of Michigan School of Forestry, obtaining both his Bachelor and Master's degree in 1938. He has had experience in forest research, timber production, the lumber business, land management, and consulting forestry work. He comes to West Virginia Pulp and Paper Company from the University of West Virginia, where he was assistant manager of an experimental forest.

### Wood Lost In Bucking

The wood lost in bucking logs, based on a study of 446 logs measured in Washington and Oregon, is described in a 4-page circular issued by the Washington Institute of Forest Products.

The report was written by E. E. Fobes, forester for the Forest Products Laboratory, Madison, Wis. It is number 23 in the *New Wood-Use Series* published to encourage more complete utilization of the timber grown in Washington.

The circular describes the log length variation and peeler block yield based on the measured logs. According to Mr. Fobes approximately 3,460 board feet is lost for every 100 logs produced. This would be equivalent to two logs 30 feet long by 36 inches in diameter with a value of $346 if logs were worth $100 per thousand.

Copies of the circular may be obtained free of charge from the Institute of Forest Products, 303 Anderson Hall, University of Washington, Seattle.


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### F.A.O. Conference Attended by J. A. Hall

Dr. J. A. Hall, director of the U. S. Forest Products Laboratory in Madison, Wis., was U. S. representative at a conference called by the United Nations Food and Agriculture Organization. Held in Rome during December it laid the groundwork for worldwide expansion of pulp and paper production, particularly in countries where raw materials exist but mills are needed.

The conference of directors of forest products laboratories in England, Canada, Australia, France, Sweden, and other countries considered a series of technical proposals worked out during the past two months by four pulp and paper specialists, including G. H. Chidester, chief of the pulp and paper division of the Forest Products Laboratory.

According to Dr. Hall, surveys by FAO show that, while world consumption of pulp and paper products is increasing, other nations lag far behind the United States. India uses less than one pound of such products per capita as compared with 330 pounds used in the United States.

As the backward nations of the world become industrialized and their peoples educated, FAO experts predict an annual increase in demand for paper of about 5 percent in coming years. To meet it, FAO hopes to encourage investment in pulp and paper mills in countries where few or no production facilities exist.

To succeed in that aim, Dr. Hall explained, FAO needs reliable technical information of the kind Chidester and his associates in Rome have been developing. This includes standard tests for pulpability of new woods—notably tropical hardwoods—and technical information on existing pulping processes.

FAO also has survey teams in various countries analyzing available raw materials and potential demand for paper. It thus hopes to provide investors with well-rounded technical and economic facts on which to base decisions as to where new mills are likely to be successful business ventures.

### Alaskan Conifer Seed May Restore Icelandic Forests

Iceland is looking for seed to restore her forests, now practically nonexistent because of thousands of years of grazing and erosion. Nevertheless Iceland has a forest policy aimed at reforestation within a hundred years. The problem is to find seed adapted to Iceland's particular climate and soil conditions.

FAO expert R. F. Taylor, who recently returned from a survey trip to Iceland, says that Alaska can supply Iceland with conifer seed.

Taylor, forester in charge of the United States Alaskan Forest Research Center, has a five year seed collecting plan through which the United States Forest Service would send its foresters out to collect Alaskan seed against reimbursement for labor from the Icelandic government.

Only international cooperation can make Iceland independent of wood imports. Taylor is recommending that FAO follow up his survey with technical assistance on seed procurement for Iceland's treeless Forestry Service.

### Forester Joins TCA in Libya

Richard W. Abbott, formerly extension forester at the University of Wisconsin, recently joined a forestry project in Libya sponsored by the State Department's Technical Cooperation Administration. Chief problem to be tackled by the mission is afforestation of near-desert regions along the Mediterranean coast, a once-forested area which has suffered severely from erosion and vegetation loss caused by overgrazing of goats.

★ ★ ★

SURVEYS of the Food and Agriculture Organization of the United Nations show that out of all the world's forests some 2,862,000,000 acres can be made to yield an industrial wood supply. But the existing wood-using industries of the world have been mainly built to employ softwoods, and vast areas of the untapped forests are tropical hardwoods. Hundreds of millions of the softwood forests, too, are in the Soviet Union and its satellite countries.

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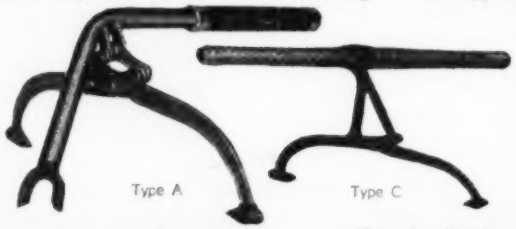


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### Tax Laws and Hogs Impede Louisiana Reforestation

Hogs and taxes are blamed by J. H. Kitchens, Jr., executive secretary of Louisiana Forestry Association, Alexandria, for the drop in demand for seedlings below the supply. He added in a recent statement that it is "unfortunate that the hog and tax situation discourages many landowners from planting more seedlings."

"Because there is no hog law," he said, "landowners are forced to build fences, which makes the cost almost prohibitive. Present tax laws give no assurance to the prospective tree planter that his taxes will not jump before time for a timber harvest."

The effect of hog damage on tree planting has been felt markedly in central Louisiana, he said. Nebo Oil Co., in LaSalle parish, cancelled orders for three million pine seedlings this year when hogs destroyed their plantations.

Kitchens pointed out that the Louisiana Forestry Commission raised a record 62 million pine seedlings this year for its reforestation program, but have sold only about 48 million so far. Gov. Kennon has called for a production of 75 million seedlings next year and 100 million each year following, but, Kitchens stated, before planters can be found for 100 million seedlings a year, some relief must come in the form of hog and tax legislation.

### Forest Service Report Gives West Virginia Statistics

The first complete scientific survey of West Virginia forests ever made shows almost two-thirds of the state's total land area to be commercial forest land. Results of the survey recently completed by the U. S. Forest Service in cooperation with the West Virginia Conservation Commission, are given in a report, *Forest Statistics for West Virginia.*

The report, prepared by the Northeastern Forest Experiment Station, Upper Darby, Pa., reveals that the average acre of forest land in West Virginia contains less than 1,800 board feet of sawtimber. West Virginia's chief forestry problem according to Ralph W. Marquis, director of the experiment station, is that of increasing the growing stock to take full advantage of the vast timber-growing potential of the area, adding that, although timber stands are depleted, growth of most species now exceeds drain and the time is ripe for good forest management.

Only 14 percent of the 10 million acres of commercial forest land contains sawtimber stands of more than 5,000 board feet per acre. About 31 percent has from 1,500 to 5,000 board feet of sawtimber per acre. More than half the total forest area contains little or no commercial sawtimber.

Nearly 90 percent of West Virginia's forest land is in hardwood, half of it oak. There remain in the state about 17½ billion board feet of standing sawtimber. Total growing stock amounts to nearly 6.2 billion cubic feet, the equivalent of about 77 million cords.

The current estimate of sawtimber volume in the state considerably exceeds those of the Forest Service and the American Forestry Association made in 1945. However, this difference is attributed to the greater accuracy of the present survey and to changes in specifications, rather than to changes in the forest resource during the past few years.


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### Missouri Names Hoyer Assistant State Forester

Milton G. Hoyer, formerly of the National Distilleries Products Corporation's Seton Porter Forest, has been appointed assistant state forester by the Missouri Conservation Commission. Hoyer takes charge of the timber management section of the forestry division.

Hoyer, a graduate of Iowa State College and a former member of the Forest Service, has worked on the Mark Twain National Forest in Missouri, national forests in the west, and at the Central States Forest Experiment Station. From 1943 to 1945 he worked under State Forester George White on the timber production war project.

### Robert B. Moore Transferred to N.P.S. Washington Office

Robert B. Moore, formerly forester in the National Park Service's Region Four office at San Francisco, has been transferred to Washington, D. C. to head the Service's Forestry Division administrative branch.

Born in Archbald, Pa., Moore holds a B.S. in forestry from Pennsylvania State College. A forester in the National Park Service since 1934, until 1947 he divided his time between Shenandoah National Park and the Region One office in Richmond. In 1947 he received a special commendation for his work in directing action on the fire line and working as liaison with the United States Air Force and other cooperating agencies in suppressing a disastrous fire in Acadia National Forest, Maine. While with Region Four he covered forestry matters in the Pacific Coast and neighboring states.

### Mississippi Memorial Forest Honors Posey N. Howell

The Posey N. Howell Memorial Tree Plantation, planned by the L. W. Dantzler Lumber Company, the First Bank of Biloxi, and the Beasley-Thomas Realty & Insurance Company, all of Biloxi, will honor one of Mississippi's outstanding conservationists.

The late Mr. Howell, an affiliate member of the Society of American Foresters at the time of his death in 1952, was employed by the Dantzler Company for more than fifty years. The plantation is intended to serve both as a recognition of Mr. Howell's achievements and as a demonstration of the practices he advocated all of his life, since it will also be an experimental and model forest.

The plantation is to be located about six miles from Biloxi in Harrison County near Cedar Lake. Formerly a barren waste which failed to re-forest by natural means after the virgin timber was logged off early in the century, it is to be planted with about 80,000 trees using mechanical tree-planters. Experiments in cultivating and fertilizing pine trees are to be carried on by the Beasley-Thomas organization as a public service. Planting started in December 1952 and was scheduled for completion by the end of January 1953.

Mr. Howell was one of the first foresters in the South to leave "seed trees" during timber-cutting, and to point out damage to young longleaf pine from unrestrained razorback hog and sheep feeding. He also devoted much time and effort to bringing the importance of elimination and control of forest fires to the general public.

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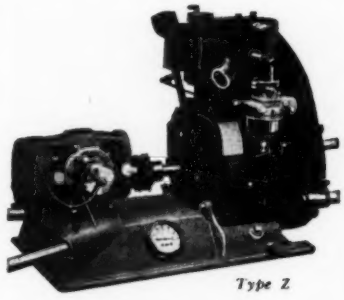

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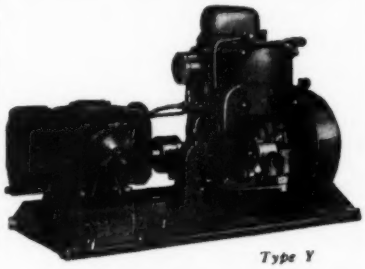

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## Central States Station Men Advising Pakistan Government

Dr. Robert K. Winters and Maxwell E. Becker, division chief and project leader respectively of the Division of Forest Resources Investigation at the Central States Forest Experiment Station in Columbus, Ohio, began a two-year assignment as advisors to the Pakistan government in November. They will assist in establishing and operating a forest experiment station and forest products laboratory in the Chittagong Hill tracts of east Pakistan.

The two-year research project, the first of its kind undertaken in Pakistan, will assemble information on the strength and other properties of timbers from native tree species to determine how they can best be grown on a continuous-crop basis, and harvested and marketed most economically.

Winters, formerly associate editor of the JOURNAL OF FORESTRY for forest economics and policy, has worked in most of the major forest regions of the United States and served with the War Production Board as a forest products specialist during World War II. While in Columbus he directed a state-by-state survey of forest resources and industries of the Central States Region.

Becker was stationed at various national forests in California and Oregon during his early career in the Forest Service. During World War II he served as a strategic intelligence officer in the War Department, attaining the rank of colonel. After the war he went to Korea under the auspices of the State Department to aid in the development of a forestry program there.

## Alaskan Industry

Alaskan industry is looking up. Besides the $400-$700 million plant Aluminum Corporation of America has proposed at Skagway, a $45 million pulpwood plant will be built at Ketchikan by the Ketchikan Pulp Co. and a $1.2 million plywood plant at Juneau by the Juneau Plywood Co. The Department of Interior notes that Alaska's forest reserves could supply 25 percent of the nation's newsprint.

★ ★ ★

SINCE THE beginning of the Korean conflict, 850 tons of supplies, at an estimated cost of more than $485,000, have been shipped by the Red Cross to the troops in Korea. These supplies included 21,486,000 envelopes, 34,841,000 letterheads, 436,000 toothbrushes, as well as thousands of books, kit bags, combs, mirrors, razors, cards, pencils, and other needed items.


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# Forestry Employment

S.A.F. members are privileged to insert one 60-word advertisement in this column without charge. Forest industries desiring to employ foresters may insert advertisements at the rate of $4 per column inch. Copy must be received by the end of this month for an advertisement to appear in the issue after next.

Obviously, the Society cannot assume responsibility beyond making it possible for prospective employee and employer to enter into negotiation.

## Positions Available

### WOODS EXECUTIVE

A new paper mill now under construction requires an executive with broad experience in large scale woods management and operation. Must possess administrative ability and be capable of organizing and directing all phases of woods program. Experience in pulpwood procurement in southern states is highly desirable. In addition, should have direct experience in management of pulpwood production activities.

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## Position Wanted

Forest Engineer, single 30. Former army officer. BSF, University of Washington; MF with Business minor, Oregon State College. 2½ years logging, engineering, and forestry experience in the southeast, western pine, Douglas-fir, and Alaska. Will consider any poison-oak free job, but prefer cost and planning work. Member SAF. Available in March.
**Box A, Journal of Forestry, Mills Building, Washington 6, D. C.**

Forester, 32, B.S.F., M.F., Colo. A. & M. Six years experience with U. S. Forest Service. Research experience in ponderosa pine management, regeneration, and related phases of silviculture. Some experience in surveying; some training in logging engineering and photogrammetry. Desires position with industry or university, preferably in the West.
**Box B, Journal of Forestry, Mills Building, Washington 6, D. C.**

Graduate forester, 26, married, desires position, preferably in Northeast. Would prefer work dealing with photogrammetry as applied to forestry. Experienced in aerial photo mapping, photo interpretation, surveying. Opportunity for learning and future advancement are main objectives.
**Box C, Journal of Forestry, Mills Building, Washington 6, D. C.**

Forester, 26, B.S.F, University of Maine 1951; married, with one child. Desires position in East. Experience in blister rust control and fire control. Just released from second tour of duty with U. S. Army as commissioned officer.
**Box D, Journal of Forestry, Mills Building, Washington 6, D. C.**

Forester, 29, B.S.F., M.F. Minnesota 1950; married, two children. Desires position in Lake States or Northeast. Experience in land acquisition, forest and game management, and public relations. Presently employed as game manager by midwest state.
**Box E, Journal of Forestry, Mills Building, Washington 6, D. C.**

**—about tree-marking paint and boundary lines?**

In the photo above, Bate Lumber Company of New Bern, N. C., marks the boundary on one of their holdings with SOUTHERN GLO red tree-marking paint. Mr. WILLIAM H. UTLEY, forester, describes the company's procedure as follows:

"We have been using red paint for boundary marking for the past five years. Our method of marking is quite simple. We mark the side hacks with paint after each survey and band with an 8-10 inch width as frequently as we can along the line to be marked. Each corner is marked with a double band on one or more trees adjacent to the corner marker. We find that the red paint stands out quite well. In addition to painting our lines, we have found it a good policy to plow fire lanes along the lines, both as a pre-suppression measure, and for the boundary establishment."

SOUTHERN GLO now markets Boundary Marking Paint, especially prepared to withstand weathering and to retain its original brilliance over long periods. This Boundary Marking Paint comes in all standard SOUTHERN GLO colors: yellow, white, red, blue and the newly introduced orange; also in aluminum.

**WHAT DO *YOU* THINK about a small-opening container for ready-mix tree-marking paint?**

A practicing forester Down East states the case for such a container very ably:

"I have made extensive tests of SOUTHERN GLO ready-mixed tree-marking paint. I find that it is all you claim:

1. It stays in suspension, thus eliminating waste.
2. It eliminates necessity for carrying a separate container of solvent.
3. It gives a uniform color.

Here is my suggestion: since there is very little need for stirring SOUTHERN GLO, it would be convenient if the can were equipped with pouring mouth or spout."

—What do *you* think? If you like the idea of a container such as this forester suggests, let us hear from you . . . we'll make it available in this form if you agree it is better adapted to field use.

SC SOUTHERN COATINGS & CHEMICAL CO.

Dept. F-2, Sumter, S. C.

## Pechanec Heads Range Research In F.S. Washington Office

Joseph F. Pechanec, formerly chief of the range research division of the Pacific Northwest Forest and Range Experiment Station was recently put in charge of all range research for the U. S. Forest Service in Washington, D. C. His successor, David F. Costello of the Rocky Mountain Forest and Range Experiment Station in Fort

JOSEPH F. PECHANEC

Collins, Colo., has been in charge of Forest Service range management experiments in Colorado, Kansas, Nebraska, South Dakota, and eastern Wyoming.

Pechanec succeeds W. R. Chapline, now with the forestry division of the Food and Agriculture Organization in Rome, who retired from the Forest Service last fall.

Pechanec did range research at the Intermountain Forest and Range Experiment Station, Ogden, Utah, for more than 13 years, going to the Pacific Northwest Station in 1945. A native of Idaho, he received undergraduate training in forestry and range management at the University of Idaho, with graduate study at the University of Idaho and Iowa State College.

In 1951 he was range and livestock specialist in a mission of the United Nations Food and Agriculture Organization to Italian Somaliland.

Author of a number of technical reports in range research and recently appointed editor of the *Journal of Range Management*, he is founder and first president of the American Society of Range Management.

### Federal and State Forest Units Receive Safety Council Awards

The Award of Honor, the National Safety Council's recognition of top proficiency in accident prevention, was presented recently to the Eastern Region of the U. S. Forest Service for its 1951 record of only one lost-time injury in 1951 among 438 full- and part-time employees.

The Council presented its second highest safety honor to the Forest Products Laboratory, Madison, Wis. A Certificate of Commendation went to the Pacific Northwest Forest and Range Experiment Station, Portland, Oreg.

Chief Forester Richard E. McArdle received the plaques on behalf of the Forest Service from Ned Dearborn, president of the National Safety Council, at a ceremony on October 28 in the Department of Agriculture building, Washington, D. C.

Regional Forester Charles L. Tebbe and safety officer George P. Kramer, both of the Eastern regional office in Philadelphia, were present to accept the eastern unit's award from Mr. McArdle.

The Alabama National Forest, Montgomery, also received a plaque in October for its first place record in the government intercity class of the Council's 1951-1952 fleet driving safety contest.

The National Safety Council is a private organization cooperating with industry, government agencies, schools, and individuals in efforts to prevent accident injuries.

### Beaverhead Ranger Receives First USDA Safety Award

W. A. Schowe of Missoula, Montana, Beaverhead National Forest ranger, first recipient of the Department of Agriculture's safety award, won this certificate of merit with a perfect safety record extending from 1950 through the first six months of 1952. The award is a feature of the Forest Service's accident prevention program initiated six years ago.

Schowe, who supervises one- to ten-man seasonal crews, uses a simple, direct, and very effective accident prevention formula. He selects reasonably reliable men, discusses the essentials of safety with each personally, keeps them in the forefront of the employee's mind by constant verbal reminders, and reviews all new jobs for possible hazards before a crew is sent out.


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## S.A.F. Dues Deductible

In filing U. S. income tax reports, all members of the Society of American Foresters may classify dues paid to the Society of American Foresters as deductible expense.

Dues for 1953 should be paid promptly and in no case should they remain unpaid after June 30, 1953. Members whose dues are not paid by that date will receive no further issues of the JOURNAL OF FORESTRY until dues are paid.

STANDARD COST ACCOUNTING FORMS for Texas sawmills, developed by E. D. Marshall, head, Forest Products Department of the Texas Forest Service, assisted by a committee of accountants from industry and the A & M College of Texas, will enable the lumber industry to determine more accurately the cost of each operation, it is believed.

The new forms are described in *Standard Accounting Forms for Texas Sawmills,* Technical Report No. 5, which may be obtained from the Texas Forest Service, Box 460, Lufkin.

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## Your Tax I.Q.

Answers to quiz on page 151.

1. c. Your son's prize here would be considered taxable income. That raises his total income to $601, and he cannot qualify as a dependent if he has income of $600 or more.
2. a. The amounts spent should be deductible as business expenses, if you kept a careful record which lists them in detail, and shows clearly that the entertainment was with a predominating business motive and not merely reciprocal, or incident to the vacation.
3. b. A non-business bad debt is a capital loss. And you can take only $1,000 a year in capital losses—unless you can apply them against capital gains. You are allowed to carry over unused losses for five years; better get expert advice.
4. b. Assuming your income is classified as self-employment income (see tax instructions) and is not from engaging in an exempt profession, a tax of 2¼% on the first $3,600 is due with your income tax return—so you owe $81.
5. c. You cannot deduct contributions to an organization which spends a substantial part of its time on lobbying or political propaganda.
6. b. In this case, you can file a claim for refund within three years from the date your return was due.
7. b. If your wife works for you, you are not supposed to pay social security taxes on her salary, nor is she supposed to make her contributions.
8. b. On leased property, you normally spread the cost of improvements over the life of the lease.
9. c. The roof is an improvement, not deductible currently like ordinary repairs. Its cost is deductible as depreciation spread over its estimated useful life.
10. c. Inheritance taxes are not deductible. The others listed are deductible.


Calder's Forest Road
**ENGINEERING TABLES**
Ready figured, for professional and axe handle engineers. Great time saver. The condensed experience of 30 years in the woods. Unbeatable for laying out roads. Absolutely weatherproof. Will send on approval (in U. S. only) to foresters and engineers for two weeks trial. Ask for it.
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# ESTERON® 245 ACHIEVES A NEW HIGH IN WEED TREE CONTROL

## Basal Bark Treatment Is Effective Any Month in the Year!

Winter has been established as a good time for basal bark application to control weed trees shading out young pines and other desirable timber species. This new forest practice—spraying the basal 12 to 15 inches of brush stems or tree trunks with Esteron 245 in kerosene, diesel or fuel oil—is more economical than cutting, and regrowth is eliminated or reduced to a minimum. Chemical release is a new, effective tool for progressive silviculturists.

Young trees of desirable coniferous or hardwood species, which cannot compete so well with tall, shady and often vigorous weed trees, grow more rapidly when these weed trees are controlled. Esteron 245 containing powerful, low-volatility propylene glycol butyl ether esters of 2,4,5-T is unexcelled for year-round basal bark spraying. (For foliage application during the growing season, Esteron Brush Killer containing low-volatility esters of both 2,4,5-T and 2,4-D is very effective on a wide variety of species.) Both products are widely used in all seasons for treating stumps to prevent resprouting.

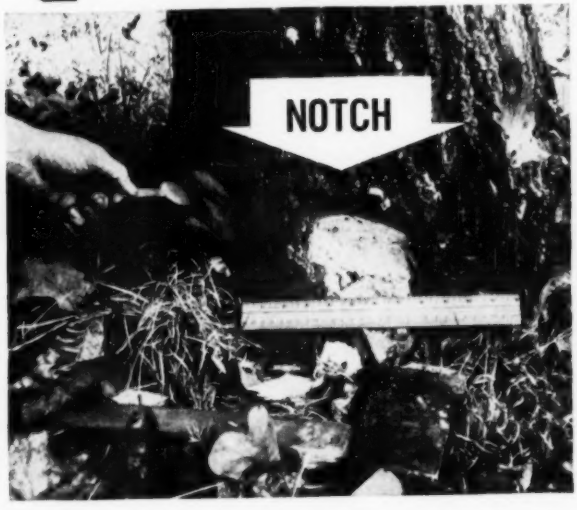
Inquiries from foresters and tree farmers on the control of weed trees with Dow's result-getting brush killers will receive prompt attention. Dow sales and technical men are available for consultation and assistance. THE DOW CHEMICAL COMPANY, *Agricultural Chemical Department*, Midland, Michigan.

*you can depend on* DOW AGRICULTURAL CHEMICALS

# 4 ways TO KILL SCRUB TREES WITH DU PONT "AMMATE"

**1** For large trees, hack overlapping cuts into the sapwood around the trunk. Pour in enough "Ammate" solution (4 lbs. to a gallon of water) to wet the cut surface all around the tree.

**3** Cut small trees with a V-shaped stump. Put a tablespoonful of "Ammate" crystals in the V. You can also use "Ammate" on larger stumps to prevent sprouting.




**2** On tough trees, chop notches every six inches near the ground. Put a tablespoonful of "Ammate" crystals in each notch. This deadens even blackjack oak with little resprouting.

**4** On seedling trees or sprouts, spray the green leaves and stems when they are fully leafed out using "Ammate," ¾ lb. per gallon of water. Let trees or sprouts stand a year for best kill.

## TIMBER GROWS FASTER when you kill Scrub Trees

You can increase the value of timber growth by killing scrub trees with low-cost "Ammate." Forest owners report it gives valuable pines more sunlight, more water and more room for root and top growth. "Ammate" kills blackjack oak, gum, sassafras, elm, willow, persimmon and other weed trees with little or no resprouting.

**Ask for this free booklet:** *"Improvement of Pine Timber Stands with Du Pont 'Ammate.'" Write to Du Pont, Grasselli Chemicals Dept., 5031 Du Pont Bldg., Wilmington, Del. For supplies of Ammate® ammonium sulfamate weed killer, see the Du Pont distributor in your area.*

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